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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

OCTOBER 1, 1988

BLAME IT ON RIO

Brazil's tough stance on imports

PAGE 46

Contract designers' credo: Design and deliver—fast PAGE 14

Look who paid no taxes to Uncle Sam in 1987 PAGE 62

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 14, NO. 19 OCTOBER 1, 1988

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REPRINTS

ELECTRONIC BUSINESS articles are available on a custom printing basis at reasonable prices. Contact Joanne Westphal, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5080, Des Plaines, Ill. 60018 (312) 635-8800

Designer labels

In the 1930s, American industrial design hit new highs as champions of the aesthetic approach — super-designers like Raymond Loewy — made form just as important as function. The approach was so successful, so emblematic of industrial vigor, that Loewy in particular was labeled as *Time* magazine's "Man of the Year" in the late 1940s.

In recent decades, though, American product design has hardly been something to be proud of. It's often safely conservative and frequently look-alike and boring.

But we're pleased to report that there are specialty design houses that are out to change the look of American products. Firms like Frogdesign, which gave Apple's Macintosh its unique eye appeal, and Theta Resources, which is sculpting sleek new shapes for mainframes.

And we're happy to note that these contract designers are doing more and more to help out the U.S. electronics industry, not only when those jaded blueprints need an artistic overhaul, but when a new product needs to be rush-designed, or designed to cost.

As our new assistant editor Tony Greene found out, shrinking product life cycles are encouraging American electronics firms to look outside for expert design. Turn to our "Business Trends" story to find out what contract designers can do for you.

Latin lure: Brazil's electronics market

Rio — Stat!

In our cover story on Brazil's huge electronics markets, we're not recommending that vendors race off to Rio at once in search of a fast buck. But we are, we hope, indicating that it may be worth taking a closer look at what some say will be the world's fifth-largest electronics market by the year 2000. We sent associate editor Valerie Rice down to Rio to interview local electronics executives, resident U.S. firms and government officials, and she brought back perhaps the most comprehensive view yet published of Brazil's fiercely protected electronics industry.

Tax tables

No apologies from us for listing, alongside our tables of the top taxpayers in the U.S. electronics industry, a sampling of the firms that actually got tax rebates from Uncle Sam last year. Our editorial judgment, you see, is that there's a very human fascination with who bested — and who was bested by — the IRS that everybody loves to hate. This alluring information is backed by a thorough article on tax tactics by associate editor Bruce Rayner.

JOHN KERR, managing editor

ELECTRONIC BUSINESS® (ISSN 0163-6197) is published semi-monthly, except monthly in December, by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington Street, Newton, MA 02158-1630. Terrence M. McDermott, President; Frank Sibley, Group Vice President; Jerry D. Neth, Vice President/Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President/Production and Manufacturing. Circulation records are maintained at Cahners Publishing Company, 44 Cook Street, Denver, CO 80206-5800. Telephone: (303)388-4511. Second-class postage paid at Denver, CO 80206-5800 and additional mailing offices. POSTMASTER: Send address corrections to ELECTRONIC BUSINESS® at the Denver address. ELECTRONIC BUSINESS® copyright 1988 by Reed Publishing USA; Saul Goldweitz, Chairman; Ronald G. Segel, President/C.E.O.; Robert L. Krakoff, Executive Vice President; William M. Platt, Senior Vice President. Annual subscription rates for non-qualified people: USA/Canada/Mexico, $55 per year; other countries, $85 per year (including air freight). $170 per year for air mail. Except for special issues where price changes are indicated, single copies of regular issues are available for $6.00, $8.00 and $10.00 (USA, Canada/Mexico and foreign). Please address all subscription mail to Eric Schmierer, 44 Cook Street, Denver, CO 80206-5800. Cahners Publishing Company, A Division of Reed Publishing USA • Specialized Business Magazines for Building & Construction • Manufacturing • Foodservice & Lodging • Electronics & Computers • Interior Design • Printing • Publishing • Industrial Research & Technology • Health Care • Entertainment. Specialized Consumer Magazines: American Baby • Modern Bride.

BPA ABP

The tax man giveth . . . and he also taketh away

The Treasury Department is poised to rule on a tax issue that could mean U.S. companies will pay more taxes on foreign sales

Just as corporate America is settling down to life in a post-tax-reform world, another tax change hits the fan. But unlike 1986, when legislative changes were all the rage, this time around the Internal Revenue Service is bent on reinterpreting a section of the tax code. The result will most likely mean that, under certain conditions, exporting companies will end up paying higher taxes. Electronics companies are at the center of the debate.

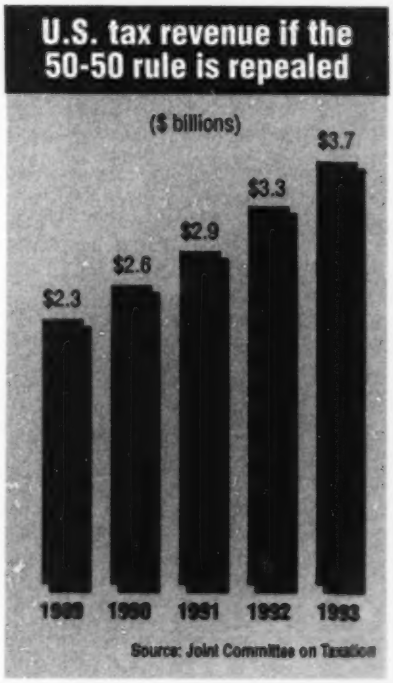
The export source issue, as it is called, is highly technical and riddled with exacting "legalese." It centers on how much Uncle Sam is entitled to collect on income earned from foreign sources through the sale of American-made goods — when title of those goods is transferred to an overseas buyer *outside* the United States. At the heart of the debate are two intertwined issues: territoriality and an ill-defined term called "independent factory price," which the IRS is claiming should be applied more often to these types of sales.

If the title of the goods sold is transferred to an overseas buyer *inside* the United States, then revenue from that sale is now considered U.S.-sourced income, and the current IRS regulations on exports do not apply. But, if the transfer of goods takes place outside of the United States, then the IRS claims it can assess an independent factory price for those goods sold. Once that independent factory price is set, the IRS can then dun the U.S. factory for the majority of the tax bill.

For both the tax man and corporate America, the stakes are high. While the IRS wants to boost taxes, corporations argue that exports will suffer as a result. By radically changing the rule, the IRS could increase taxes by over $2 billion a year, according to the congressional Joint Committee on Taxation. Such a change means annual exports would drop between $3.6 billion and $5.3 billion, counters the Export Source Coalition (ESC). The ESC, a Washington, D.C.-based lobbying group, wants to maintain the status quo on the export source rule. Almost half of its 41 member companies are electronics firms and three out of 11 trade groups are from the electronics industry.

Guinea pigs

The disproportionate concern by the high-tech community is no coincidence. Two prominent Silicon Valley companies, Intel Corp. and Hewlett-Packard Co., are being used by the IRS as guinea pigs in its challenge of the export source rule. In its audits of both companies, the Internal Revenue Service argues that the widely accepted interpretation of the export source rule has been inappropriately applied. As a result, both companies face possible higher tax burdens and lengthy legal battles should they decide to fight the Treasury's definition of independent factory price when it is made public.



An added concern voiced by William Pearlman, a vice president at Intel, is that no American company has set up a reserve to cover the additional tax expense should the IRS get its way. "It could be significantly negative for all companies," Pearlman warns. The IRS could legally apply the rule retroactively, charging companies for all tax years still open to federal scrutiny. For some companies, that means digging back 20 years into internal tax records.

Tax experts caution, however, that high tech has not been singled out for special scrutiny. Intel and HP are in the spotlight, they say, simply because they happen to be inside the IRS' western regional jurisdiction. And, unfortunately for both companies, the international tax experts in the IRS San Francisco office have been the prime movers in this issue and insist their auditors pursue it as far as they can. This suggests that West Coast electronics companies are more likely to feel the long arm of the IRS than their counterparts in other regions of the United States. The western region includes Alaska, California, Hawaii, Idaho, Nevada, Oregon and Washington.

The 50-50 rule

Meanwhile, the Treasury Department is trying to resolve the issue as diplomatically as possible. It has to balance the zeal of the IRS against the economic consequences of stifling exports. While it went part way to pacify corporations by agreeing in late August that the old interpretation — the so-called "50-50 rule" — will continue to be the predominant interpretation, it has yet to define the meaning of an "independent factory price." Treasury called for definitions from concerned corporations to be submitted by mid-September and was expected to come out with its own definition by early October. By press time, however, no definitive ruling had been handed down.

Depending on how the independent factory price is defined will determine how extensively companies can apply the old interpretation of the rule. One interpretation of the independent factory price distributes taxable income between United States and foreign sources based on contri-

bution to value added. If the independent factory price is not applicable, then companies will still be allowed to use the 50-50 rule, whereby 50% of the income on the sale can be classified as foreign-sourced income, and the remaining 50% as U.S. income.

Although it is tough to generalize, corporate tax accountants say that most companies prefer using the 50-50 formula method for two reasons: it is more straightforward; and it usually means lower taxes. If they are forced to apply the independent factory price, companies worry that the change could effectively lower the 50-50 rule to something closer to 10-90.

While the IRS refuses to comment on its audits, sources expect Hewlett-Packard could be the first to test the legality of the issue. According to Lester Ezrati, HP's tax counsel, the company will have three options: before paying anything, it could either take the case to the IRS appeals branch or go directly to tax court; alternatively, it could first pay the tax then take the case to the U.S. district court and try to overturn the ruling. Ezrati says that since the issue is so technical, HP would be better off going directly to tax court.

BRUCE C.P. RAYNER

How the new tax code works

Let's say that America Inc. sells $1,000 worth of chips to Deutschland AG and makes $100 taxable income on the sale. The goods are manufactured by and shipped from America Inc.'s San Jose facility directly to Deutschland's Munich headquarters. As a result of this, title is transferred to Deutschland in Munich.

Also assume that America Inc. has a branch in XYZ country that also manufactures and sells chips. The branch makes $100 of taxable income on sales of which it pays $50 in taxes to the government of XYZ country. The branch sends the remaining $50 profit back to the home office of America Inc. in San Jose in the form of a remittance of profits. The branch does not pay XYZ country any withholding tax.

The U.S. tax rate is 34%, so the U.S. tax on the total $200 income would be $68 before any adjustments are made.

A. Assume that America Inc. is allowed to use 50-50 export source rule, meaning that 50% of the $100 income from the Deutschland AG sale is considered foreign and 50% is considered domestic. So, of the $200 of total income, $150 of it is considered foreign source taxable income. The calculation of the foreign tax credit limitation (FTCL) used to offset U.S. taxes is as follows:

$$\frac{\text{Taxable foreign source income}}{\text{Total taxable income}} = \frac{\$50+\$100}{\$200} = 75\% \times \$68 = \$51 \text{ of U.S. tax}$$

The applicable FTCL is the lower of the foreign taxes paid ($50) or the above calculation ($51). It is the foreign taxes of $50. America pays the IRS only $18 ($68 minus $50). Under the 50-50 rule, America's total worldwide taxes are $18 plus $50, or $68.

B. Assume that America Inc. has to apply the independent factory price to its income on the Deutschland AG sale. So, 90% of the $100 income is derived from the U.S. factory and 10% is considered foreign-source income. The calculation of the FTCL used to offset U.S. taxes would be:

$$\frac{\text{Taxable foreign source income}}{\text{Total taxable income}} = \frac{\$10+\$100}{\$200} = 55\% \times \$68 = \$37.50$$

The applicable FTCL would then be only $37.40 (the lower of the FTCL or total foreign taxes paid). So America Inc. would pay the IRS $30.60 ($68 minus $37.40). Total worldwide taxes are $30.60 plus $50, or $80.60 □

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Brazil could be the world's fifth-largest electronics market by the year 2000. But obstacles to doing business there are many — as American vendors are finding

Blame it on Rio

Brazil's tough stance on imports

BY VALERIE RICE

With a rapidly growing population of 160 million people and a land mass bigger than all of Europe, Brazil is poised to be one of the major economic forces of the next century. But an economy crippled by runaway inflation, incredible poverty, and internal political struggles jeopardizes that future. So the country's hopes are pinned on the bright spot in Brazil: an electronics industry, which many believe to be the fastest growing in the world today.

But the Brazilian Informatics industry, as they call their electronics sector, is at a turning point. Politicians have made decisions which could forever hinder Brazil's goal to be a major electronics player, and businessmen, frustrated by missed opportunities and an oppressive government, are demanding reform. Meanwhile, one of the tastiest market opportunities in years seems to be slipping out of reach.

The world electronics market would like a piece of the action in Brazil, and American companies are no exception. Americans are evaluating the market possibilities, but, like the rest of the world, are puzzled by the market dynamics. They're also put off by widespread allegations of Brazil's intellectual property piracy, and by the restrictions imposed by the nation's notorious Informatics Law. Opportunities do exist for U.S. firms, but only patience, creativity and luck can ensure entrance into the market.

The Brazilian electronics industry last year was an almost $2 billion market (roughly one-fifth the size of Texas' electronics market) and is growing at more than 30% per year, according to U.S. Department of Commerce and other figures. It already manufactures huge volumes of TVs, VCRs and appliances, not to mention a giant auto industry that is a voracious consumer of chips from suppliers such as Motorola Inc. The American Electronics Association predicts that Brazil could be the fifth-largest electronics market in the world by the year 2000.

But that growth has come at the expense of a free market, as the Brazilians slammed their doors shut in 1984 to give indigenous companies a chance to grow their own. This policy of "market reserve" — reserving the market for themselves in terms codified in the Informatics law — restricts the import of any product containing digital computing power, as well as software and technical services.

Items not included under this law are, for example, mainframe computers, printed circuit boards and anything to do with telecommunications. Also restricted are technology exchanges or joint ventures, as well as equity participation by a foreign company if it owns the technology. The Informatics law is an eight-year law, set to end in 1992. What may replace it, if anything, is unknown.

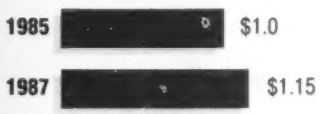
Brazil took this step because "we are different than any other nation," de-

Claus Meyer/Black Star

The Brazilian electronics market

Hardware

Includes peripherals, PCs to mainframes and ATMs ($ billions)

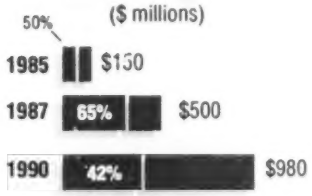


These figures represent mostly indigenous Brazilian industry, with the exception of the mainframe sector, which is almost entirely supplied by multinationals (IBM) or imports. ATMs make up a significant percentage.

Source: ELECTRONIC BUSINESS estimates

Semiconductors

($ millions)



Of the $190 million in locally made chips in 1987, about $60 million is from U.S. companies; $55 million from Siemens/Philips; about $40 million from other European companies and Japanese suppliers; and only $35 million from native Brazilian companies.

Sources: ELECTRONIC BUSINESS estimates, Sid Micro

Software

Includes PC to mainframe software ($ millions)

The personal computer software portion of these numbers does not include the value of pirated software, which could account for as much as 50% of the market.

Source: ELECTRONIC BUSINESS estimates

when the Informatics law ends, these three companies must show demonstrable ability in running a 2-micron CMOS fab. Right now, CMOS technology does not really exist in Brazil outside of research facilities.

Protection needed

Of all the industries in Brazil, the fledgling semiconductor industry is the most at risk if the doors of the country are opened. Victor Blatt, managing director of Sid Microeletronia SA, acknowledges that "without the Informatics law, we wouldn't be able to exist. We would be competing with multinationals. We need this protection to continue for a few more years."

This protection has allowed Sid to be profitable. And, since the company grew at a rate of 20% last year, it expects to reach $40 million in revenue at the end of 1988.

What the Brazilians want to go after, according to Blatt and others, is "90% of what's produced that isn't memory or microprocessors." One area in which Blatt feels Sid is making strides is ASICs. Thanks to the market reserve, Sid can take the time to get an ASICs group up and running, and can afford to hire the very best from the universities. Using Mentor Graphics Corp. equipment, Sid has started an ASIC subsidiary, Verte Sid Sistemas Integrados (VSI), that is currently tackling the Brazilian market with a staff of 30."We can be more than competitive in this," he claims, "because our cost of engineering is lower and we have very good people."

Itautec is also striving after the ASICs market, and company *diretor comercial/industrial* Gabriel Antonio Marao claims that he has put in design centers in Brazil, and has done 25 different designs to date. Itautec, which is owned by the major Brazilian merchant bank Itau, is involved with two consortiums in Brazil which are trying to start a chip set industry. The 14-member consortium has already developed a PC AT chip set which was delivered in production quantities last month, and hopes to do an Intel 80386 chip set as well. □

A price comparison

U.S. versus Brazil on PC XT and Apple IIe (in U.S. dollars)

PC XT

	U.S.	Brazil
CPU	$1,350	$3,300
Monitor	400	1,500
Hard drive	300	4,500
Total system	$2,050	$9,300

Apple IIe

	U.S.	Brazil
CPU	$280	$300
Monitor	80	300
Drive	75	285
Disk interface	90	66
Total system	$525	$988

Source: Exame Informatica

Breaking into Brazil: A business primer

A word of warning for Americans considering Brazil as a market: it's not for the faint of heart or short of term.

First there's the question of timing. Current market reserve policy is due to end in 1992, which could mean that the country will then be more open to foreign investment. So companies in business before then could have a distinct advantage over the newcomers. But the main issue is, of course, how to get products into a restricted country. American companies can sell pretty much directly into Brazil in areas not covered by the Informatics law. Those include telecommunications, printed circuit boards, and any mainframe technology.

There are other areas, covered by Informatics, but difficult for the Brazilian market to provide, that Americans could have access to. Brazil's computer industry association indicates that products in these sectors may be welcome: CAD/CAM software and systems, CRTs, terminals, semiconductor production and test equipment, power supplies and high-end engineering terminals. And Brazil's lack of CMOS fabs makes semiconductors one of the most obvious opportunities.

But American companies wanting to get into Brazil must play the game. Finding a Brazilian distributor or sales representative can be difficult. The president of one small components company who recently spent two weeks in Brazil has given up because his telexes never get answered. And once a representative is found, agreements must be made, and then

SEI must review the paperwork and make a decision.

The best business in Brazil is conducted over a cup of coffee. Not just any coffee, but a *capezhino*, a strong, sweet cup of coffee served in a demitasse cup. But drinking the offered coffee with a smile is just the start when doing business in Brazil. Consider the following:

- Americans doing business in Brazil have to constantly think about money. For example, although the minimum wage is $50 per month, employees get a "raise" every month — the percentage is set by the government — to offset inflation. And contracts, ironclad in the United

States, are often renegotiated every month to allow for current pricing.

- Negotiate contracts in dollars, rather than the local currency of *cruzados*. A good recruiting tool in Brazil is to offer to pay an executive in dollars.
- With ever-changing laws and policies, it is best to have a Brazilian law firm on retainer. Intellectual property protection is a prime consideration in Brazil, and having access to a Brazilian law firm can help minimize the risks.
- Portuguese is the official language, and any petitions to the government or bureaucratic bodies must be done in Portuguese. Hiring a translator — or a native — is a must.
- Be prepared for red tape. It can take 18 months or longer to get a license to import a product, so there is no fast turnaround or just-in-time policy making in Brazil. □

The Brazilian black market: Do you know the way to Paraguay?

In downtown Sao Paulo there is a street, the "electronics alley," where rumor has it that a customer can get anything — anything — he wants. Table after table of parts, from components to transistors to alligator clips, cover the street, and only the proprietors know what is on the back shelves of the stores.

But shopping on Avenida Santa Effegia is not for those who don't speak Portuguese.

This is the black market, *the mercado paralelo*, where items not available legally in Brazil, or at the right price, can be found — if one knows the right people.

Smuggling in Brazil is not isolated to one street in Sao Paulo. Instead, it seems that a large number of small- and medium-sized businesses regularly smuggle small amounts of product just to stay alive. Larger companies, too, often turn to smuggling to augment supplies or cut costs.

Contraband

In addition, estimates indicate that 50% of the personal computers in Brazil were smuggled in, and up to 40% of the software is either smuggled or pirated. And some sources also say the amount of smuggling is growing.

In fact, the amount of electronic merchandise smuggled into Brazil last year exceeds legal shipments of United States products to the country, by almost one-third. At the same time, United States electronics shipments to Brazil last year were worth about $230 million, while contraband into Brazil last year was estimated at over $300 million, according to the U.S. Department of Commerce.

The semiconductor figure alone could be even larger. The Brazilian government suggests that over $600 million worth of contraband components are in Brazil at any time.

Motorola Inc.'s Robert Salatka, director of international marketing, says he can't account for the large installed base of his products in Brazil; the company just doesn't sell that much product there.

"There are very good indications that contraband is alive and well and occurring with some frequency," Salatka says. "Brazil stops imports toward the end of the year when the balance of trade is not favorable for them."

A source close to the U.S. government and an expert on Brazil notes that "contraband is a tremendous business in Brazil. What occurs between Brazil and Paraguay is not a secret, and it's not just electronics. It's gold for agricultural products and autos for other things. If someone needs something fast, the black market is the way to go."

All of this is because products legally imported to Brazil go through nine tariffs and and one brokerage tax, the end result of which can be as much as 150% on top of the original price of the product.

Reasons to smuggle

The high tariffs are one reason that large companies often smuggle. Although most computer companies have import permits for products they require, they are rumored to import minimal amounts of product, and to smuggle the rest, in order to amortize the high cost of the legality across a number of products.

Although large companies contacted in Brazil deny involvement with the black market, one vendor suggests that even the government is involved.

One reason smuggling is so prevalent is Brazil's close proximity to Paraguay, where legality seems more flexible than in many places.

Potential smugglers can rent a warehouse in Paraguay; establish a phony business; rent a truck; and use one of the five overland routes or transport the smuggled cargo by a water route from Paraguay into Bra-

Smuggled goods such as electronics and automobiles often come down from Miami to Paraguay. From there the goods travel overland by different routes into Brazil, a nation hungry for foreign products

zil; all without blinking an eye.

Before the product gets to Paraguay, it travels by plane from Miami, where a host of small distributors cater to the Latin American market, with or without legal intent. Many of these are small "garage" operations, and most operate on referrals. None contacted would speak with the press. Another big source is Miami's ComputerLand store, where traveling Brazilian businessmen often stop before coming home.

Electronics smuggling has taken on a more sinister feel lately, say involved Brazilian locals, because drugs have entered the scene. Drug smugglers, operating out of South America, want a load to bring back from the United States and what better than in-demand electronics?

"Drug smugglers love electronics items," says one Brazilian computer industry official. □

Staying one step ahead of the pirates in Brazil

Cloning United States high-technology products is big business in Brazil, and clones, from software look-alikes to personal computers, are flourishing, thanks to the high import duties on legal products.

But for an American company finding non-licensed clones of its products, getting legal recourse may tend to be a very difficult task. If a copyright, trademark or patent is not registered in the country of Brazil, its owner cannot go to court in Brazil to seek damages or an injunction against the infringer. And often times foreign companies choose not to register in Brazil, because if the registered patent, for example, is not used within a two year period, it essentially becomes public property.

Yet, Brazil should be on its best behavior these days, thanks to the threat of U.S. trade sanctions. Although the sanctions have currently been suspended, they could be reinvoked at any time if Uncle Sam decides that Brazil is not acting fairly with regard to market access or intellectual property protection.

So if there's evidence that an American product, logo or trademark is being copied, the time to act is now. One expert source of information on this subject is Apple Computer Inc.'s director of government affairs, James Johnson. Johnson is an attorney who spearheaded Apple's successful push to squash upstart Macintosh clone maker Unitron Eletronia without going to court.

Four-step program

In a four-step program, he suggests approaching the United States Trade Representative's office and the International Trade Administration office with the evidence. Johnson stresses that a government protest carries a lot of weight, and says companies should highlight the connection to the U.S. government's national trade case against Brazil.

Next, the infringed company should send a "cease and desist" letter to the offending Brazilian company. Then the Special Secretariat for Informatics (SEI) should be alerted to the situation. "This is a violation of Brazilian law," Johnson states. "Even if we can't go to court, it is against the law." Johnson also suggests that U.S. companies retain a Brazilian lawyer.

The final step, and one that was successful for Apple, is tipping off the local press. Johnson claims that the press in Brazil is sympathetic to the U.S. viewpoint, and "that kind of exposure can be very effective." □

Manaus: Free trade zone in the Amazon

The Amazon region in Brazil is hardly a place anyone would expect business to flourish. That portion of the country is illiterate, agrarian and consists primarily of favellahs, or slums, according to the U.S. council for commercial affairs in Brazil, Arthur Trezise.

Yet the severely depressed northeast region of the country is getting a shot in the arm, thanks to the free trade zone center established in Manaus, the only major city at the foot of the Amazon. Travelling American businessmen liken it to any American industrial zone, the only jarring note being the proximity of the river and the jungle.

In this free trade zone, companies can import or export parts without restriction, and the bulk of the products are exported. Because of the cheap wages ($50 per month), Manaus is mainly a giant assembly operation, with almost 400 companies operating there, according to the council for commercial affairs.

But companies operating in the Informatics arena are excluded from participation in Manaus, and electronics industry officials claim the

success of the free trade zone comes at the expense of their industry.

In this very closed market, Manaus represents a low-cost way in, at least to cheap manufacturing. The bulk of the foreign companies doing business in Manaus export their products, and executives argue that Brazil is no better off with this export mentality. Executives also complain that the Informatics industry in Brazil is short on capital and incentives, and they're more than happy to blame Manaus.

"One of the reasons Brazilian industry is not as competitive is because of Manaus," says ABICOMP (Brazilian Computer Industry Association) board member Ricardo Saur. "Manaus is entirely incentive driven and it's artificial."

The existence of Manaus, established during Brazil's almost 30 years of military rule, also runs counter to the Brazilian philosophy of owning its own technology. In Manaus, most of the technology is foreign-owned, and consumer electronics companies, a large percentage of Brazilian companies operating in Manaus, are unable to be competitive in the world export market because of this, executives argue.

"Most critics sarcastically refer to Manaus as the import processing zone, rather than the export processing zone," Saur says. □

American companies in Brazil: Doing business the hard way

How do American companies do business in a country with such restrictive markets?

Carefully, and with patience, says Fairchild Semiconductoras Ltda. *gerente geral*, or general manager, Hank Mahler. Fairchild, which has been making diodes and transistors in Brazil for 15 years, has learned how to "go with the flow," according to Mahler.

Fairchild is not alone. There are almost 400 American companies doing business in Brazil, although most are not in high tech. Those, like Fairchild, IBM, Motorola Inc., NCR Corp., Unisys Corp. and others, that are in the market reserve area, have been grandfathered in under the new law, and allowed to continue operations.

According to Mahler, things haven't been so bad there. "In the long term, business is good here," he says. "That's something that a lot of American businesses have difficulty accepting."

The hardest things to adjust to, according to Mahler, have been the rapid economic and political changes that tend to obscure the long-term direction the country is taking.

Another challenge is the lack of local infrastructure, which makes planning for the future difficult, Mahler says. Multinationals in Brazil must give SEI a plan at the beginning of every year that outlines import needs quarter by quarter. That plan, if SEI approves it, is pretty much set in stone, Mahler says, and "forces you to be right most of the time."

Ironically, Fairchild and presumably the other American companies have benefitted from market reserve, despite the increase in red tape. "The same benefits a local company gets from market reserve we also get. We have been very successful in gaining market share," he says.

But for American companies not established in Brazil, the going can be rough. Computer and terminals maker Wyse Technology has evaluated Brazil and the market reserve policy, and decided instead to invest in Venezuela, says international sales manager Mark Kvamme.

"In the past 12 months, South America has been a strategic market development area for us," Kvamme says. "Brazil is the largest market, but it has the largest local content rules and the greatest number of hoops to go through. It is just not attractive to do business there right now."

Another company that does not find expanded investment attractive is Texas Instruments Inc. Although TI has been doing business there for 25 years, it announced last year that it would be willing to make a "substantial investment in Brazil if there is a reason to do so."

For TI, the bait is tempting. Brazil represents a huge market for consumer goods, automobiles, telecommunications products and ultimately computers, much of which remains untapped.

But TI would want to enter on its own terms, the same terms it uses worldwide: a 100% owned subsidiary, which is positively verboten under Informatics law for a foreign company. Even equity participation isn't allowed currently. Talks continue with the Brazilian government, but TI doesn't seem optimistic. "We are still in the stage of getting the government to allow us in," says a spokesman. □

Randall Hyman/Stock Boston

clares Brazilian Computer Industry Association (ABICOMP) board member Ricardo Saur. "You cannot compare us. Other nations are export oriented. We are not — we want to satisfy our own needs. We can't do that without protection."

CIA running high tech?

Overseeing this legislation is the Special Secretariat for Informatics, or SEI, which has been known to strike fear in the hearts of even the most honest high-tech company. Word is that SEI, set up under the military regime, is akin to the U.S. National Security Council. Brazilians note that having SEI oversee the electronics market is a lot like having the CIA running high-tech legislation in the United States.

Be that as it may, SEI is virtually the final word on everything electronic, from imports to exports, as well as which products can be produced in Brazil, and which must be brought in from the outside. Foreign companies must get approval from SEI to export to Brazil (no mean feat), while indigenous companies must get approvals on foreign supplies and equipment. SEI is nominally overseen by CONIN, a national council on Informatics, but that body is generally seen as impotent when compared with SEI.

SEI tends to make its import decisions based on whether or not the technology already exists in Brazil. If it does, or can be made to exist, a foreign company is out of luck. If it doesn't exist, there are certainly opportunities.

"This is a very complicated country," says one senior Brazilian electronics executive who declined to be named. "There is too much government intervention and it is a directed economy. It is difficult to do business here."

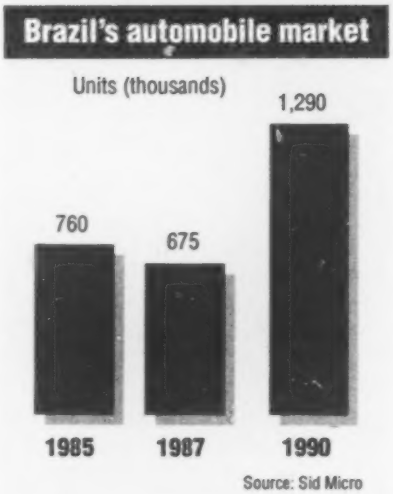
The difficulties all begin and end with the government, according to one American executive who is trying to set up a joint venture in Brazil. "Being in Brazil makes our government look easy to work with," he says.

Unlike the United States, merchant banks are legal and very powerful in Brazil, and they all have a hand in the Informatics industry. Itau is one of the largest banks in Brazil, as well as one of the biggest Informatics players. The same is true for Citicorp/Elebra. So if the Brazilians have a market development model, it is very much like that of Japan.

"Brazil is trying to emulate the Japanese development models," says U.S. Department of Commerce's Brazil expert Robert L. Farris. "This is planned development. There is a lot of government and industry cooperation, and the market targets are very specific. This is not a shotgun approach to business."

Since the Informatics law was established in 1984, the Brazilian electronics industry has been hampered by the nation's economic recession. Inflation is averaging 18% per month, and industries like computers and automotive have not grown significantly over the past few years. The relatively stagnant computer industry has not hurt the Brazilians as much as expected. It is a much smaller portion of the overall electronics market than in other countries. Yet there are growth segments in Brazil; unlike the United States, the consumer industry is very strong, as are telecommunications and military sectors.

Robert Fried/Stock Boston



Brazil's giant auto industry is a voracious consumer of chips from suppliers such as Motorola

Nothing is easy

For American companies considering doing business in Brazil, it is necessary to understand the dynamics. Change is the order of the day; after all, Brazil has rewritten its constitution nine times in the past 100 years.

Under the market reserve system, Brazil shut its doors before it had an infrastructure established to support its electronics industries, and it lacks the expertise — and capital — to develop its own. Brazilian executives acknowledge this with disgust, noting that although they have incentives through tax breaks to use Brazilian-made goods, the products are —more often than not — unavailable, or at best, sole-sourced.

Importing the necessary parts, be it components, silicon wafers, gold lead wiring, solder, etc., brings with it an unbelievable set of tariffs, which can add between 30% and 105% to the cost of the goods. The answer for many companies has been a spot of judicious smuggling (see related story).

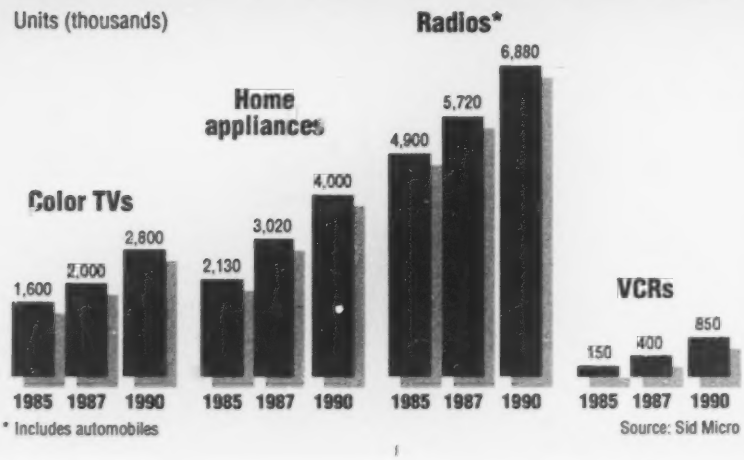
Another challenge to the Brazilian Informatics industry has been the flourishing growth in the free-trade zone in Manaus, a northeast region that has successfully attracted foreign business. Industry in Manaus has grown at an astonishing rate, but the Informatics portion of Brazil's domestic industry is barred from participating in this export-only zone.

According to one Brazilian semiconductor executive, all of the country's problems can be traced to a lack of capital. Indeed, his explanation of the Informatics law reveals that no one in Brazil could afford to invest in high technology without the law, and the government, needing technology for national security reasons, was forced to close the doors.

One area Brazil has succeeded in

Owen Franken/Stock Boston

Major Brazilian consumer electronics markets



nurturing has been the personal computer market, certainly the largest segment of the indigenous computer market. But even the PC business isn't easy, since Brazilian companies have difficulty competing with (smuggled) American computers, which are cheaper and often more efficient.

Right now, there are over 100 companies in Brazil trying to get a share of the PC software and hardware market; most of it is IBM-compatible, although there is some cloning of Apple Computer Inc. products. Right now, state-of-the-art technology is a Motorola 68020 microprocessor, with the largest installed base; followed by the Intel Corp. 80286 and the ever-popular 8086. Up and coming are, of course, the 68030 and the 80386, but there is little evidence of RISC chips entering the country as yet. The Brazilian portion of the data-processing market stops at the superminicomputer level; IBM, which has been in Brazil since 1914, has virtually 100% of the mainframe market — allowed because mainframes are not part of the Informatics law.

Because volume is low, economies of scale don't really exist in Brazil, and working conditions are often far from a "clean room" atmosphere, and can have an impact on the quality of products.

Government-owned computer manufacturer Cobra Computadores e Sistemas Brasilieiros SA is a good example. Cobra is one of the largest PC manufacturers in Brazil, and also makes products up to the superminicomputer level. But the company has upward of 20% absenteeism per month, and manufactures, in a good month, only 1,000 computers with its 1,000 employees.

Hiring complaints

And, because it is government owned, it cannot pay competitive salaries, so executives complain about not being able to hire good software and hardware engineers.

That is just the beginning of Cobra's problems. Cobra does very little manufacturing itself; it is more of an assembly house, and imports most of its parts from the United States. But under the market reserve system, it is difficult and expensive — really expensive — to import chips and other parts, so the system costs skyrocket. It can take upward of 18 months to get an import permit in Brazil, and then it can be restrictive as to quantity and type.

Given all these self-made obstacles, it is difficult to believe that anyone in the country would support market reserve. Many Brazilian businessmen don't; others, however, like ABICOMP, make compelling arguments in favor of keeping the doors closed until the law ends in 1992. Says board member Saur: "Unless specific measures were taken temporarily, Brazilian industry would have no chance to compete on the worldwide market."

Joint ventures, often a way low-technology countries can get up to speed quickly, are seen as inappropriate for Brazil, Saur says, because "they bring in technology and access, but they don't bring in technology at the level the Brazilian people wanted."

One small pocket of market reserve supporters can be found in the semiconductor industry in Brazil. SEI licensed three semiconductor vendors under the Informatics law: Elebra, Itautec and Sid Microeletronica, and they are the heart and soul of the industry.

The term "manufacturer" should be used loosely in Brazil. Two of these three companies do not have fabs, and the third, Sid Micro, has a very old linear/discrete fab which produces, in actual fact, very few parts. These companies are essentially resellers or distributors of U.S., Japanese or European chips in Brazil.

The problem with the lack of front-end fabs in Brazil is that by 1992,

Well! Look who paid no '87 taxes to Uncle Sam!

IBM, AMD, Xerox and others actually got rebates from the IRS in 1987. But possible tax hikes and more complex rules spell headaches for high tech

BY BRUCE C.P. RAYNER and LINDA STALLMANN

They must have great tax attorneys. Last year, big wheels in the U.S. electronics industry — companies like Data General Corp., IBM and Zenith Electronics Corp. — not only paid no federal tax, but many received tax credits.

Part of the reason is that U.S. electronics firms are more reliant on foreign operations than ever before; for example, in 1987, almost all of IBM's tax provision went to governments overseas. In part, too, the rebates are thanks to deferred investment tax credits. But with the repeal of the investment tax relief laws, that's a situation that may not be repeated.

Indeed, increased tax-law complexities and the threat of budget-balancer tax increases from a new White House administration do not bode well for high tech. On average, electronics-industry taxes were already higher in 1987 than in the previous year.

The dust has yet to settle on the Tax Reform Act of 1986. With a technical corrections bill being hammered out in Congress and the Internal Revenue Service trying to interpret the bill, corporate America is doing its best to get a handle on what is going on. It is not an easy task.

According to the ELECTRONIC BUSINESS annual survey of the top electronics industry taxpayers for 1987, the figures are superficially encouraging (see chart). For the 130 companies on the list, the average effective tax rate dropped from 42.9% in 1986 to 39.4% in 1987. For the top 20 companies, all but six posted a decline in their effective tax rates between 1986 and 1987. Only those companies from the ELECTRONIC BUSINESS 200 [July 15, 1988] that derive at least 70% of their total revenue from electronics qualified for inclusion on this list.

Not surprisingly, IBM was again the top electronics taxpayer, accounting for 39% of total 1987 tax provisions of the companies listed. In fact, IBM set more aside for taxes in 1987 than the next top 12 companies combined — but not a cent of that money is going to Uncle Sam. The Feds wound up *giving* Big Blue a credit of $113 million on its U.S. earnings of nearly $4 billion based on deferred investment tax credits of $141 million. Among the other 23 companies that came off clean with Uncle Sam were seventh-ranked Xerox Corp. and 37th-placed Perkin-Elmer Corp.

On the surface, the electronics industry has survived tax reform with minimal damage. True, the investment tax credit is no longer around, nor is the capital gains differential. But a watered down version of the research and experimentation (R&E) tax credit, a big perk for high tech, looks to be a shoo-in for a two-year extension. It is up to the congressional Joint Committee on Taxation to work out the details, but most high-tech Hill watchers are confident the R&E credit will survive.

However, taking a closer look behind glossy annual reports and industry aggregates reveals an unsettling picture of the aftermath of reform. For example, if IBM is taken off the ELECTRONIC BUSINESS top taxpayers list, the remaining 129 companies ended up by posting an *increase* in their average effective tax rate last year, from 35.7% in 1986 to 39.6% in 1987. Again, excluding IBM, the total tax burden increased by 67.8% between 1986 and 1987, while net income rose by 63%.

Rebates all around...

Federal tax credit for fiscal 1987 ($ millions)

IBM	$113.00
Perkin-Elmer	25.79
Teradyne	11.50
Zenith	11.00
Data General	9.11
Decision Industries	6.29
Xerox	6.00
Cipher Data	3.49
Esterline	3.31
Andrew	2.48
Micropolis	1.35
Sun Electric	1.22
BRIntec	0.81
Coherent	0.38
Applied Materials	0.31
Cherry Electrical	0.25
AMD	0.09

Sources: ELECTRONIC BUSINESS and company reports

Too complex

Besides higher rates and more taxes, electronics companies insist the new law has added considerably to the administrative burden of doing business. "If you talk to the typical company chiefs, they will say that the complexity due to the transition is what strikes them the most, not that they are paying more or less in taxes as a corporation," comments James LeMunyon, a lobbyist for the American Electronics Association (AEA) in Washington, D.C.

Even the accountants are concerned. Reform has complicated their work to the point where they cannot function without a computer. The biggest culprits, they say, are the alternative minimum tax (AMT) and the new uniform capitalization rules. "You have to raise the question of whether or not our tax system has gone a little bit haywire if the only way you can get your tax compliance

Jean Francois Allaux

done is by buying a computer program," comments Kent Schreiner, a principal in the Boston office of Ernst & Whinney, a Big Eight accounting firm.

Some high-tech tax experts warn that tax reform goes further than just higher bookkeeping costs. They complain that start-up activity is being hampered by the restrictions on net operating loss (NOL) carryforwards and a higher capital gains tax. Also, defense contractors are being squeezed as a result of the repeal of the completed contracts method of accounting, which used to allow a contractor to defer taxes. Without it, productivity, research and development and capital investment will drop significantly, defense industry leaders say. "It is like taxing a farmer as soon as he plants his crop," complains Don Fuqua, president of the Aerospace Industries Association. The drought in the defense business does not help either.

Tax reform is making itself felt on the international front too. Reform has lowered the U.S. tax rate below that of most trading partners, thus making international tax planning more critical for American companies that operate overseas. Because of the new rules, the complexity of international tax planning has also increased significantly. As a result, Big Eight accountants are recommending their clients reevaluate all their offshore operations.

Nowhere is this more evident than in electronics. For the ELECTRONIC BUSINESS top taxpayers, over 60% of 1987's taxes went to foreign governments, reflecting a significant reliance on offshore manufacturing and international markets. In the case of top taxpayer IBM, the foreign tax burden is even more pronounced. In 1987, 99.6% of IBM's tax provision went to foreign governments, even though only 54% of its products were sold overseas. This resulted in an effective foreign tax rate of 58.7% last year for Big Blue.

Despite the rhetoric from Washington about rebuilding America's international competitive position, tax reform has made it more difficult for U.S.-based high-tech companies to export, claims Mark Singer, a tax partner at the accounting firm of Price Waterhouse in San Jose. "I think it is almost a policy question that at a time when we are concerned with our balance of trade with other countries, some of the changes have discouraged exports from an economic standpoint," he says.

How to stifle foreign business

In particular, Singer points to limitations on foreign tax credits as an example of how tax reform is stifling foreign business. Also, various changes in the tax laws, such as the "super royalty," mean that operations in low-tax countries such as Ireland or Switzerland have become less attractive. In essence, the super royalty charges a license fee on technology transferred offshore based on the market value of the product that is being maufactured, a rate higher than companies previously had to pay.

"Super royalty is most likely bad tax policy," says Howard Slayen, a tax partner-in-charge at the San Jose/Menlo Park office of Coopers & Lybrand, a Big Eight accounting firm. Slayen complains that in its zeal to close a loophole, "Congress went too far in coming up with a system that is not rational and not in conformity with accepted international standards."

In an unrelated foreign tax issue, the Internal Revenue Service is changing its interpretation of how a company can pass title across international borders. Based on its interpretation of section 863(b) of the tax code, the IRS used to let companies transfer title outside the United States and use the foreign source income toward a tax credit on U.S. taxes. But now, the IRS is making it harder to claim that credit.

Given such a climate, most tax experts suggest close scrutiny of foreign operations as the first step toward more effective tax planning. However, because of the November election and the expected tax changes in 1989, the planning horizon should be kept short — no more than two or three years, the pencil pushers say.

Another possibility, says Ernst & Whinney's Schreiner, is for electronics companies to change the capitalization ratios in their foreign subsidi-

aries. A higher debt burden, he says, could be a way to save money. For instance, instead of issuing shares in the foreign company, make a loan from the U.S. parent. In this way, the subsidiary can take a tax deduction while the U.S. parent company pays a relatively lower tax rate in-country on the interest income it earns.

Back on the domestic front, a new Financial Accounting Standards Board (FASB) statement No. 96 is changing the way all corporations have to report their income taxes. The new rule is mandated to take effect on Dec. 15 of this year. Initially, FASB 96 had the support of the accounting community, but because of its complexity, many tax accountants have changed their opinion.

"There will be many high-tech companies whose earnings will be adversely affected by FASB 96, which, as a result, will be reporting higher income expense and lower earnings to the public," says Singer at Price Waterhouse. The lower earnings might prompt some companies to change their corporate planning strategies, he speculates.

In essence, the 100-page FASB statement forces corporations to report their deferred taxes to take into account any current or subsequent changes in tax rates. The reason is so that the balance sheet better reflects the true liability of taxes due, says an FASB spokesperson. But many accountants contend that the new ruling will create wild swings in the tax expense and on the bottom line. And with tax rates changing every few years, the fluctuations in the financial reports could distort the public's perception of the health of the company. According to Ernst & Whinney's Schreiner, FASB 96 will also affect how foreign taxes are reported, thus creating even more of a whiplash effect in company figures.

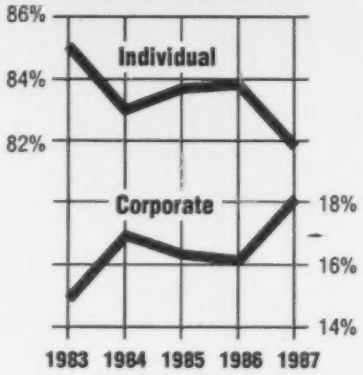
The next surprise

The whiplash will most likely be compounded. Corporate America's next surprise will be what the new president will do to reform the reform. Watch for the National Economic Committee's report, due out early next year, to set the stage for tax policy changes. Pundits expect the report will condone tax increases — possibly corporate rate increases — as one way to get a handle on the 1990 federal budget deficit.

The bottom line on tax reform

Corporations have been footing more of the tax bill...

Percentage of income and profit taxes collected by the IRS



Source: IRS

...and tax reform isn't helping

Estimated additional tax revenue paid by U.S. corporations as a result of the Tax Reform Act of 1986 ($ billions)

Sources: Department of Treasury, Office of Tax Analysis

But for now, the best that tax planners can do is guess at what the tax laws will be like next year. Besides some vague generalities, neither presidential candidate is committing to concrete fiscal strategy. Vice President George Bush has said he would reinstate the 15% capital gains tax, but little else has been heard from either candidate.

Adding to the political uncertainty is the future chairmanship of the powerful Senate Finance Committee that is currently held by Texas senator and Democratic vice-presidential hopeful Lloyd Bentsen. If Massachusetts Gov. Michael Dukakis wins the presidential election, the chair will probably go to ranking Democrat Spark Matsunaga of Hawaii.

Whoever gets elected, the critical task ahead will be how to handle the federal budget deficit. Economists agree it will involve both raising taxes and lowering spending. David Wyss, chief financial economist at Data Resources Inc., expects some increase in "sin taxes" on tobacco and alcohol, but does not see much chance for a proposed value-added tax or even any significant change in the corporate tax rate. However, if Congress finds itself in dire need, "the corporate rate is one they are likely to come after," he says. Wyss also speculates on a drop in the capital gains tax to around 20%, down from its current 28% level, coupled with a leveling off of the top personal tax rates to around 32%.

It is still too early to have hard and fast numbers on the economic effects of tax reform. Even when the figures become available, it will be difficult to isolate those changes caused by tax reform. But one of the critical gauges that economists are watching is the rate of capital investment. Some doomsayers claim that tax reform has crippled manufacturing investment, while others point to healthy investment growth in early 1988 as proof that investment decisions are being made more on economic grounds than on the basis of favorable tax breaks. The reality is probably a combination of the two.

A study conducted by Gordon Richards, an economist at the National Association of Manufacturers in Washington D.C., estimates that $30 billion in gross national product growth has been wiped out by tax reform. The main reason for the drop was the one time increase in the cost of capital as a result of the repeal of the investment tax credit, he says.

But for the electronics industry, there have been mitigating circumstances that have helped to dampen the negative effects of tax reform, says Richards. The fall in the value of the U.S. dollar has spurred U.S. sales of computers and data-processing equipment, while the steady drop in prices of electronic equipment has offset the repeal of the ITC. For the present then, high tech should count itself lucky. □

Taxes paid by top electronics companies

Rank	Company	Total income tax provision (benefit) ($ millions) 1987	1986	Percentage change from 1986	1987 income tax provision (benefit) ($ millions) Federal	State and local	Foreign
1	IBM	$3,351.0	$3,600.0	-6.9%	($113.0)	$128.0	$3,336.0
2	DEC	551.5	240.1	129.7%	297.1	48.7	205.8
3	GM Hughes Electronics	378.1	366.1	3.3%	319.3	62.3	(3.5)
4	Unisys	369.5	(48.4)	NM	186.6	24.1	158.8
5	NCR	343.1	283.2	21.2%	95.4	10.4	237.4
6	Hewlett-Packard	318.0	264.0	20.5%	82.0	37.0	199.0
7	Xerox	262.0	112.0	133.9%	(6.0)	6.0	262.0
8	Tandy	213.6	186.4	14.6%	193.5	17.7	2.4
9	Apple Computer	192.9	155.8	23.8%	146.2	27.9	18.9
10	AMP	180.8	129.7	39.4%	57.1	19.1	104.6
11	Honeywell	158.2	26.9	488.1%	79.0	14.7	64.5
12	Texas Instruments	157.8	59.0	167.5%	101.0	NA	57.0
13	Amdahl	125.0	29.5	323.7%	92.9	17.1	15.0
14	Intel	112.3	8.7	1,198.8%	67.3	14.9	30.1
15	Litton Industries	110.8	56.9	94.8%	86.5	15.3	9.1
16	Motorola	108.0	71.0	52.1%	65.0	17.0	26.0
17	Pitney Bowes	95.7	93.3	2.5%	51.3	13.7	30.7
18	Compaq Computer	92.7	31.9	190.6%	72.0	3.3	17.4
19	Cray Research	85.3	100.4	-15.0%	70.0	10.1	5.3
20	Tandem Computers	79.3	50.7	56.4%	45.0	12.4	21.9
21	Tektronix	51.9	3.0	1,628.3%	12.9	2.4	36.6
22	Microsoft	49.5	26.7	85.0%	NA	NA	NA
23	Seagate Technology	46.0	1.6	2,782.1%	35.6	10.4	0.0
24	Intergraph	45.9	53.1	-13.6%	32.4	3.4	10.1
25	General Instrument	41.7	11.2	272.3%	26.9	4.5	10.2
26	Loral	41.3	41.3	0.0%	37.0	4.3	0.0
27	Harris	37.9	1.1	3,323.3%	28.3	6.7	2.9
28	E-Systems	35.8	47.8	-25.1%	35.8	NA	NA
29	Medtronic	34.9	34.9	0.0%	17.9	4.6	12.4
30	Ashton-Tate	33.9	28.1	20.8%	21.5	6.7	5.7
31	Sun Microsystems	32.8	9.0	263.9%	17.4	5.8	9.7
32	Control Data	32.5	10.0	225.0%	7.4	3.5	21.6
33	Molex	32.0	21.3	50.3%	1.8	0.8	29.4
34	Lotus Development	30.9	22.7	35.8%	21.7	1.7	7.5
35	Atari	30.7	22.2	38.3%	25.4	0.1	5.1
36	Computer Associates	30.6	14.7	107.8%	18.2	2.5	9.9
37	Perkin-Elmer	24.8	39.7	-37.4%	(25.8)	1.4	49.3
38	Scientific-Atlanta	24.3	(6.4)	NM	20.9	1.2	2.2
39	Avnet	23.8	18.4	29.3%	20.0	3.9	0.0
40	Gould	23.2	22.5	3.1%	5.6	1.1	16.5
41	Cullinet Software	22.4	11.1	101.2%	21.6	0.7	0.1
42	Prime Computer	21.6	15.6	38.0%	14.1	1.3	6.2
43	National Semiconductor	19.5	14.5	34.9%	18.2	2.2	(0.9)
44	Diebold	19.4	21.8	-11.1%	16.8	2.6	—[1]
45	Wang Laboratories	19.0	5.0	280.0%	0.3	0.5	18.2

[1] Foreign and federal taxes reported together

NM = Not meaningful
NA = Not available

Effective tax rate		Fiscal 1987 revenue and income ($ millions)			Foreign revenue as a percentage of total revenue	Fiscal year ended	1987 ELECTRONIC BUSINESS 200 rank	Location
1987	1986	Total revenue	Income before taxes	Net income*				
38.9%	42.9%	54,217.0	8,609.0	5,258.0	54.0%	12/87	1	Armonk, N.Y.
32.7%	28.0%	9,389.4	1,689.0	1,137.4	47.0%	6/87	4	Maynard, Mass.
42.0%	45.1%	10,481.0	899.2	521.1	11.6%	12/87	3	Detroit, Mich.
39.0%	-52.7%	9,712.9	947.5	578.0	43.6%	12/87	5	Detroit, Mich.
45.0%	45.7%	5,640.7	762.4	419.3	54.6%	12/87	11	Dayton, Ohio
33.1%	33.8%	8,090.0	962.0	644.0	49.0%	10/87	8	Palo Alto, Calif.
31.2%	16.6%	10,320.0	840.0	578.0	44.9%	12/87	7	Stamford, Conn.
46.6%	48.2%	3,452.2	458.8	242.3	1.6%	6/87	17	Ft. Worth, Texas
47.0%	50.3%	2,661.1	410.4	217.5	27.1%	9/87	22	Cupertino, Calif.
42.0%	44.1%	2,317.8	430.5	249.7	52.3%	12/87	34	Harrisburg, Pa.
38.4%	67.6%	6,679.3	411.9	253.7	20.6%	12/87	10	Minneapolis, Minn.
38.1%	59.8%	5,594.5	414.7	256.9	31.5%	12/87	12	Dallas, Texas
46.8%	42.9%	1,505.2	267.0	142.0	44.3%	12/87	41	Sunnyvale, Calif.
39.0%	5.0%	1,907.1	287.9	175.5	38.8%	12/87	35	Santa Clara, Calif.
44.5%	44.4%	4,419.7	249.0	138.1	22.7%	7/87	20	Beverly Hills, Calif.
26.0%	26.8%	6,707.0	416.0	308.0	43.8%	12/87	9	Schaumburg, Ill.
41.9%	46.3%	2,250.5	228.7	199.4	19.5%	12/87	31	Stamford, Conn.
40.7%	41.7%	1,224.1	228.1	136.3	26.0%	12/87	47	Houston, Texas
36.7%	44.6%	687.3	232.4	147.1	37.0%	12/87	68	Minneapolis, Minn.
42.9%	44.3%	1,035.5	184.9	105.6	44.4%	9/87	52	Cupertino, Calif.
50.3%	7.1%	1,395.9	103.0	51.2	42.2%	5/87	44	Beaverton, Ore.
40.8%	40.5%	345.9	121.3	71.9	42.3%	6/87	86	Redmond, Wash.
24.8%	4.4%	958.1	185.7	139.7	43.6%	6/87	53	Scotts Valley, Calif.
39.6%	43.0%	641.1	115.8	69.9	36.9%	12/87	71	Huntsville, Ala.
38.6%	37.7%	787.9	107.9	18.5	16.2%	2/88	50	New York, N.Y.
41.8%	41.8%	690.0	98.7	57.5	6.2%	3/87	61	New York, N.Y.
31.0%	1.8%	2,079.0	122.4	84.5	14.7%	6/87	30	Melbourne, Fla.
37.2%	43.7%	1,227.2	96.2	60.4	6.6%	12/87	54	Dallas, Texas
32.1%	32.1%	502.0	108.7	73.8	41.5%	4/87	79	Minneapolis, Minn.
44.0%	48.2%	267.3	77.0	43.1	30.3%	1/88	129	Torrance, Calif.
47.5%	43.0%	537.5	69.1	36.3	32.0%	6/87	65	Mountain View, Calif.
56.6%	3.6%	3,366.5	57.4	25.0	20.0%	12/87	26	Minneapolis, Minn.
42.2%	39.7%	386.8	75.8	43.4	68.4%	6/87	90	Lisle, Ill.
30.0%	32.0%	395.6	102.9	72.0	52.3%	12/87	94	Cambridge, Mass.
41.0%	47.0%	493.2	74.8	44.2	45.9%	12/87	82	Sunnyvale, Calif.
45.6%	44.3%	309.3	67.1	36.5	48.7%	3/87	74	Garden City, N.Y.
372.6%	35.4%	1,333.6	6.7	-18.2	46.2%	7/87	46	Norwalk, Conn.
50.0%	-41.0%	495.3	48.5	24.3	15.0%	6/87	81	Atlanta, Ga.
51.1%	43.6%	1,547.1	46.6	22.8	0.0%	6/87	42	New York, N.Y.
48.1%	39.4%	933.4	48.2	25.0	38.0%	12/87	60	Rolling Meadows, Ill.
44.7%	46.0%	174.9	-50.0	-27.6	26.4%	4/87	153	Westwood, Mass.
25.0%	25.0%	960.9	86.4	64.8	48.0%	12/87	58	Natick, Mass.
209.7%	10.8%	1,867.9	-9.3	-28.8	42.1%	5/87	36	Santa Clara, Calif.
35.1%	38.4%	439.1	55.1	35.8	7.0%	12/87	101	Canton, Ohio
36.8%	8.9%	2,836.7	-51.7	70.7	40.1%	6/87	21	Lowell, Mass.

Source: ELECTRONIC BUSINESS

* Net income or loss before extraordinary items and discontinued operations

(Continued)

Taxes paid by top electronics companies

Rank	Company	Total income tax provision (benefit) ($ millions) 1987	1986	Percentage change from 1986	1987 income tax provision (benefit) ($ millions) Federal	State and local	Foreign
46	Dynatech	$18.5	$18.5	0.0%	$13.1	$2.0	$3.4
47	Digital Communications	17.6	14.0	25.9%	15.6	2.0	0.0
48	Western Digital	14.7	7.2	104.4%	6.8	4.0	4.0
49	Maxtor	14.6	14.6	0.0%	10.6	3.7	0.3
50	MAI Basic Four	14.6	11.3	29.1%	4.5	1.3	8.7
51	Gerber Scientific	13.3	13.3	0.0%	11.2	1.5	0.6
52	Xidex	12.8	20.2	-36.6%	10.2	2.3	0.4
53	Apollo Computer	12.7	6.0	113.8%	4.2	1.9	6.7
54	Oracle Systems	12.3	4.6	168.1%	9.1	2.2	0.9
55	Ultimate	12.2	12.2	0.0%	9.4	1.8	1.0
56	Stratus Computer	12.2	10.0	22.4%	8.1	2.2	1.9
57	Bolt Beranek and Newman	11.9	8.4	41.4%	10.9	1.1	NA
58	Mentor Graphics	11.4	5.5	105.9%	5.0	0.5	6.0
59	Wyse Technology	11.3	7.9	43.5%	9.1	2.1	0.2
60	Watkins-Johnson	11.0	12.7	-14.1%	10.9	0.0	0.0
61	Measurex	10.7	9.8	9.5%	4.6	0.9	5.2
62	Mark IV Industries	10.7	8.4	27.5%	9.6	—[2]	1.1
63	Varian Associates	10.5	(25.3)	NM	3.5	1.3	5.7
64	AVX	10.5	(1.3)	NM	8.9	0.9	0.6
65	ADC Telecommunications	10.2	9.0	13.2%	9.2	1.0	0.0
66	Emerson Radio	9.4	9.4	0.0%	5.2	0.7	3.6
67	Micropolis	9.1	14.1	-35.8%	(1.3)	3.0	7.5
68	AST Research	8.7	22.1	-60.7%	4.7	1.5	2.4
69	Genicom	8.6	7.4	16.7%	5.2	1.0	2.4
70	Avantek	8.3	13.3	-37.3%	6.8	1.5	0.0
71	Veeco Instruments	7.9	0.2	3,282.0%	1.1	(0.3)	7.1
72	Recognition Equipment	7.5	6.0	24.8%	2.1	—[2]	5.4
73	LSI Logic	7.0	4.1	70.8%	2.3	1.3	3.4
74	Augat	7.0	(3.8)	NM	2.9	0.9	3.2
75	Analog Devices	6.9	8.7	-20.2%	0.2	0.4	6.3
76	Inmac	6.9	4.4	55.4%	3.8	0.8	2.3
77	Dynascan	6.6	6.0	10.6%	6.6	0.0	0.0
78	Altos Computer	6.1	11.2	-45.5%	4.2	1.4	0.6
79	Logicon	6.1	6.1	0.0%	5.1	1.0	0.0
80	ISC Systems	6.0	9.9	-39.1%	5.3	0.8	NA
81	Marshall Industries	5.9	11.0	-46.8%	4.8	1.1	0.0
82	Storage Technology	5.6	17.7	-68.4%	2.7	(0.1)	3.0
83	Compugraphic	5.4	1.8	196.2%	NA	NA	NA
84	Cubic	5.2	(0.3)	NM	4.1	1.1	0.0
85	MiniScribe	5.1	2.8	82.1%	3.0	0.9	1.2
86	Wyle Laboratories	4.7	2.7	75.6%	3.8	0.9	0.0
87	Datapoint	4.2	8.0	-47.5%	1.3	0.0	2.9
88	Fluke	4.2	4.8	-12.4%	3.6	NA	0.5
89	Anthem Electronics	4.1	2.9	40.8%	3.3	0.8	0.0
90	Coherent	4.1	3.4	19.8%	(0.4)	0.3	4.2

[2] State taxes included with federal

NM = Not meaningful
NA = Not available

Effective tax rate		Fiscal 1987 revenue and income ($ millions)			Foreign revenue as a percentage of total revenue	Fiscal year ended	1987 ELECTRONIC BUSINESS 200 rank	Location
1987	1986	Total revenue	Income before taxes	Net income*				
44.3%	44.3%	$304.7	$41.7	$23.2	25.4%	3/87	102	Burlington, Mass.
39.4%	40.4%	181.4	44.6	27.0	19.0%	6/87	160	Alpharetta, Ga.
25.6%	26.0%	462.5	57.5	42.8	36.9%	6/87	76	Irvine, Calif.
39.4%	39.4%	175.3	36.9	22.4	16.0%	3/87	142	San Jose, Calif.
38.9%	40.0%	321.0	37.4	22.8	64.1%	9/87	106	Tustin, Calif.
38.9%	38.9%	223.9	34.2	21.1	47.0%	4/87	138	Hartford, Conn.
33.5%	38.5%	572.8	38.2	-44.5	29.9%	6/87	85	Sunnyvale, Calif.
37.0%	39.0%	553.7	34.4	21.7	51.8%	12/87	78	Chelmsford, Mass.
44.0%	43.7%	131.3	27.9	15.6	46.8%	5/87	172	Belmont, Calif.
47.0%	47.0%	172.9	26.0	13.8	23.4%	4/87	159	East Hanover, N.J.
38.7%	42.5%	184.2	31.6	19.4	29.2%	12/87	174	Marlboro, Mass.
305.2%	42.7%	233.8	3.9	-8.0	0.0%	6/87	122	Cambridge, Mass.
36.0%	33.5%	221.8	31.7	20.3	45.9%	12/87	151	Beaverton, Ore.
38.5%	38.6%	260.0	29.5	18.1	20.2%	3/87	95	San Jose, Calif.
38.1%	42.5%	264.3	28.7	17.1	19.0%	12/87	133	Palo Alto, Calif.
28.6%	31.7%	227.4	37.5	26.8	59.4%	11/87	149	Cupertino, Calif.
38.6%	45.1%	403.0	27.8	17.0	14.6%	2/88	113	Amherst, N.Y.
33.0%	-63.0%	982.8	31.9	21.4	23.6%	9/87	56	Palo Alto, Calif.
39.9%	-29.2%	271.9	26.3	15.8	43.0%	12/87	123	Great Neck, N.Y.
40.0%	42.9%	166.9	25.4	15.3	12.4%	10/87	178	Minneapolis, Minn.
26.2%	26.2%	810.1	36.1	26.6	0.0%	3/87	63	Secaucus, N.J.
25.0%	43.7%	288.3	36.3	27.2	69.7%	12/87	121	Chatsworth, Calif.
40.0%	44.9%	206.0	21.7	13.0	19.6%	6/87	119	Irvine, Calif.
45.1%	46.2%	302.2	19.2	12.6	32.0%	12/87	116	Waynesboro, Va.
41.8%	45.2%	213.7	19.9	11.6	13.0%	12/87	152	Santa Clara, Calif.
41.9%	13.0%	195.6	18.8	9.2	46.1%	9/87	156	Melville, N.Y.
40.0%	40.0%	264.7	18.7	11.2	49.1%	10/87	126	Irving, Texas
40.7%	48.2%	262.1	17.3	10.7	[illegible]%	12/87	134	Milpitas, Calif.
37.9%	-30.3%	313.2	18.4	11.5	[illegible]%	12/87	111	Mansfield, Mass.
27.0%	27.0%	370.4	25.6	18.7	46.4%	10/87	97	Norwood, Mass.
47.0%	46.8%	165.4	14.6	7.7	59.2%	7/87	181	Santa Clara, Calif.
54.4%	49.5%	191.6	12.1	6.6	2.1%	12/87	168	Chicago, Ill.
38.8%	35.7%	153.9	15.8	9.7	42.0%	6/87	188	San Jose, Calif.
50.2%	50.2%	204.8	12.2	6.1	0.0%	3/87	155	Torrance, Calif.
48.0%	41.7%	168.5	12.6	6.5	0.0%	6/87	176	Spokane, Wash.
51.3%	51.2%	286.6	11.4	5.1	0.0%	5/87	105	El Monte, Calif.
22.8%	51.3%	750.0	24.6	19.0	26.4%	12/87	66	Louisville, Colo.
34.8%	35.0%	367.1	15.5	10.1	28.9%	12/87		Wilmington, Mass.
39.8%	-33.5%	361.8	13.2	7.9	0.0%	9/87	114	San Diego, Calif.
15.2%	12.1%	362.5	33.2	28.1	36.1%	12/87	99	Longmont, Colo.
45.0%	38.5%	368.0	10.5	5.8	0.0%	1/88	132	El Segundo, Calif.
7.7%	NM	312.1	-54.3	-58.5	79.2%	7/87	110	San Antonio, Texas
67.5%	28.1%	206.3	6.2	2.0	40.5%	9/87	157	Everett, Wash.
45.2%	52.0%	196.9	9.1	5.0	0.0%	12/87	162	San Jose, Calif.
136.9%	NM	159.0	3.0	-1.1	46.4%	9/87	185	Palo Alto, Calif.

Source: ELECTRONIC BUSINESS

* Net income or loss before extraordinary items and discontinued operations

(Continued)

Taxes paid by top electronics companies

Rank	Company	Total income tax provision (benefit) ($ millions) 1987	1986	Percentage change from 1986	1987 income tax provision (benefit) ($ millions) Federal	State and local	Foreign
91	Singer	$4.0	$6.8	-41.2%	$1.3	$0.0	$2.7
92	SCI Systems	4.0	8.5	-52.9%	NA	NA	NA
93	CTS	3.9	3.5	14.1%	2.4	0.6	1.0
94	Applied Magnetics	3.9	0.8	415.3%	2.0	1.1	0.8
95	Aydin	3.8	5.2	-27.7%	3.0	0.8	0.0
96	Micom Systems	3.7	3.7	0.0%	1.0	1.7	1.1
97	Intelligent Systems	3.7	1.5	151.0%	3.0	0.7	0.0
98	TIE/communications	3.6	3.1	16.2%	2.7	0.7	0.2
99	Westmark International	3.4	(10.9)	NM	2.5	0.7	0.3
100	Pioneer-Standard	3.4	1.3	162.1%	2.8	0.6	0.0
101	DSC Communications	3.1	2.4	27.9%	0.2	2.6	0.3
102	Cherry Electrical	3.0	(1.5)	NM	(0.3)	—[2]	3.3
103	Tandon	2.8	2.3	19.1%	2.2	—[2]	0.5
104	Sprague Technologies	2.7	1.8	50.0%	0.5	0.2	2.0
105	Computer Consoles	2.6	2.0	29.2%	0.2	2.3	0.1
106	BRIntec	2.5	6.8	-63.3%	(0.8)	0.2	3.2
107	Advanced Micro Devices	2.5	(9.1)	NM	(0.1)	1.6	1.0
108	Dataproducts	2.1	2.1	0.0%	0.1	0.7	1.3
109	Quantum	2.1	9.6	-78.4%	0.7	1.4	0.0
110	Paradyne	1.7	0.8	98.0%	0.0	0.4	1.3
111	Diasonics	1.6	1.3	26.2%	0.2	0.1	1.3
112	VLSI Technology	1.3	0.3	389.6%	0.2	1.0	0.1
113	General DataComm	1.3	(2.4)	NM	0.2	0.3	0.8
114	Andrew	1.2	6.8	-82.5%	(2.5)	0.6	3.1
115	GenRad	1.1	0.8	43.8%	0.0	0.1	1.0
116	Oak Industries	0.8	2.7	-70.6%	0.1	0.1	0.6
117	LTX	0.7	(6.2)	NM	0.0	0.0	0.7
118	International Rectifier	0.6	0.7	-9.8%	0.0	0.5	0.1
119	Kollmorgen	0.6	(2.7)	NM	0.0	0.0	0.6
120	Sun Electric	0.5	2.3	-78.2%	(1.2)	0.0	1.7
121	Savin	0.3	0.0	NM	NA	NA	NA
122	Applied Materials	0.2	0.9	-73.1%	(0.3)	0.3	0.2
123	Arrow Electronics	0.0	0.0	0.0%	0.0	0.0	0.0
124	Esterline	(2.6)	1.4	NM	(3.3)	0.6	0.1
125	Cipher Data Products	(3.5)	3.4	NM	(3.5)	0.2	0.9
126	Data General	(4.0)	4.9	NM	(9.1)	(1.0)	6.1
127	Decision Industries	(6.0)	3.4	NM	(6.3)	0.2	0.1
128	Zenith Electronics	(9.8)	(10.2)	NM	(11.0)	(1.1)	2.3
129	Teradyne	(11.7)	(2.9)	NM	(11.5)	(0.3)	0.1
130	M/A-COM	(19.6)	(16.5)	NM	NA	NA	NA
	Total	**$8,541.2**	**$6,694.3**	**27.6%**	**$2,649.9**	**$641.1**	**$5,192.3**

[2] State taxes included with federal

NM = Not meaningful
NA = Not available

Effective tax rate		Fiscal 1987 revenue and income ($ millions)			Foreign revenue as a percentage of total revenue	Fiscal year ended	1987 ELECTRONIC BUSINESS 200 rank	Location
1987	1986	Total revenue	Income before taxes	Net income*				
14.6%	10.4%	$1,902.7	$27.4	$23.4	0.0%	12/87	40	Stamford, Conn.
20.0%	38.1%	552.9	20.0	16.0	24.8%	6/87	73	Huntsville, Ala.
27.3%	14.9%	261.1	14.4	10.5	19.7%	12/87	135	Elkhart, Ind.
21.6%	15.6%	211.9	18.1	14.2	46.5%	9/87	144	Goleta, Calif.
30.0%	42.8%	149.2	12.6	8.8	17.8%	12/87	199	Horsham, Pa.
23.3%	23.3%	196.7	15.9	12.2	10.0%	3/87	154	Simi Valley, Calif.
23.6%	61.8%	163.2	15.5	10.2	26.6%	12/87	189	Norcross, Ga.
48.4%	5.6%	250.2	-7.4	-11.1	30.3%	12/87	125	Shelton, Conn.
89.9%	-39.8%	291.9	-3.8	-7.2	28.0%	12/87	118	Seattle, Wash.
39.2%	40.9%	212.2	8.6	1.8	0.0%	3/88	143	Cleveland, Ohio
17.3%	17.8%	312.4	17.6	14.6	14.4%	12/87	112	Plano, Texas
52.6%	-38.8%	160.6	5.8	2.7	49.4%	2/87	190	Waukegan, Ill.
13.9%	3.8%	289.1	19.8	17.1	75.0%	12/87	120	Chatsworth, Calif.
42.9%	1.1%	437.3	6.3	3.6	38.2%	12/87	89	Greenwich, Conn.
21.3%	84.9%	148.4	12.2	9.6	21.4%	12/87	200	Waltham, Mass.
29.8%	36.8%	293.7	8.4	5.9	15.8%	12/87	150	Willimantic, Conn.
5.6%	8.8%	997.1	-45.1	-48.1	27.2%	12/87	57	Sunnyvale, Calif.
19.0%	19.0%	338.8	11.1	9.0	26.8%	3/87	107	Woodland Hills, Calif.
19.0%	30.1%	120.8	10.9	8.8	21.0%	3/87	177	Milpitas, Calif.
176.0%	2.2%	232.6	-0.9	-2.6	17.9%	12/87	146	Largo, Fla.
9.7%	8.0%	267.6	16.9	15.2	3.1%	12/87	127	South San Francisco, Calif.
14.0%	82.7%	172.0	9.4	8.1	22.1%	12/87	184	San Jose, Calif.
62.5%	NM	200.6	2.1	0.8	21.9%	9/87	166	Middlebury, Conn.
23.9%	41.8%	223.2	5.0	3.8	40.7%	9/87	147	Orlando Park, Ill.
34.7%	2.6%	193.8	3.2	2.1	40.4%	12/87	165	Concord, Mass.
12.3%	9.8%	182.2	6.5	5.7	14.4%	12/87	182	Rancho Bernardo, Calif.
11.8%	-32.9%	120.6	-6.0	-6.7	51.0%	7/87	198	Westwood, Mass.
3.6%	60.6%	151.8	-16.6	-17.2	50.1%	6/87	197	Los Angeles, Calif.
67.1%	-11.8%	301.0	0.9	0.3	11.4%	12/87	136	Hartford, Conn.
5.4%	62.4%	203.9	-9.2	3.3	30.0%	10/87	175	Crystal Lake, Ill.
72.8%	0.0%	356.3	0.4	0.1	10.8%	12/87	130	Stamford, Conn.
41.9%	42.0%	174.4	0.6	0.3	43.9%	10/87	158	Santa Clara, Calif.
0.0%	0.0%	562.4	-15.8	-15.8	0.0%	12/87	77	Farmingdale, N.Y.
-8.2%	59.9%	259.7	-31.9	-29.3	39.1%	10/87	167	Darien, Conn.
NM	31.9%	178.2	0.2	4.3	18.4%	6/87	183	San Diego, Calif.
-5.8%	35.0%	1,274.3	-69.9	-82.9	45.0%	9/87	45	Westboro, Mass.
-22.7%	30.7%	191.4	-26.4	-20.4	5.5%	11/87	169	Horsham, Pa.
33.9%	-50.5%	2,362.7	-28.9	-19.1	17.2%	12/87	29	Glenview, Ill.
-35.3%	NM	377.7	-33.2	-21.5	36.4%	12/87	98	Boston, Mass.
-40.1%	-42.6%	436.1	-48.9	-29.3	21.5%	9/87	88	Burlington, Mass.
39.4%	—	**$202,336.8**	**$21,693.1**	**$13,276.5**				
Weighted average								

Source: ELECTRONIC BUSINESS

* Net income or loss before extraordinary items and discontinued operations

Capital spending: The boom will end, but '89 is no bust

Capital equipment vendors should enjoy 1988 while they can -- 1989 forecasts call for a slower spending pace. Big-ticket buys could continue

BY LINDA STALLMANN AND DAVID CARD

Forecasters expect electronics companies to slow their capital spending pace in 1989.

That's the bad news. The good news is that the comparison is relative to 1988, which will close out as a capital equipment boomlet.

The top 100 U.S. electronics companies spent $14.3 billion on capital equipment last year, up 3.9% from what those same companies spent in 1986. (Only those companies from the ELECTRONIC BUSINESS 200 [July 15, 1988] that derive at least 70% of their total revenue from electronics are compared.) This year's growth will be even greater, as projections for some specific industry sectors suggest.

According to a survey by Lexington, Massachusetts-based Data Resources Inc., companies making electrical and electronic components will increase their spending this year by 42.7% compared with last year. The research firm shows spending by communication equipment companies up 13.6% in 1988, and office equipment makers up 25.8%.

But watch out for 1989, cautions DRI economist Nigel Gault. Preliminary budgeting plans at component companies call for only a 19% increase in 1989. And communication and office equipment suppliers will cut spending by 10% and 11.3%, respectively.

Gault points out that there is a "built-in tendency to underestimate spending plans," so 1989 probably will not be as bad as the early budgets indicate. Capital equipment vendors, Gault says, "shouldn't be planning on an increase like 1988, but at the moment, it looks like 1989 will be a reasonably good year."

Caution on 1989 is the watchword with other forecasters too. If she were an equipment supplier, Elizabeth Baatz of Cahners Economics says, "I wouldn't be terrified, but I'd be keeping my eye open" looking toward 1989. Cahners Economics is pretty negative on the general economy, expecting a 1989 gross national product growth of only 1.1%.

Rebound in 1990

Cahners Economics forecasts manufacturing spending across all industries to increase 10.7% in 1988, but expects it to shrink 0.9% the next year. 1990 will rebound, with spending growing 5.2%. "Things people can order in smaller quantities will drop off sooner," Baatz says of 1989, indicating that spending on expensive items — automatic test equipment, for example — may hold up longer, but drop off in early 1990.

Last year, semiconductor companies spent the most on capital equipment as a percentage of sales. Custom chip makers LSI Logic Corp. and VLSI Technology Inc. spent 67% and 29%, respectively.

However, the spree is over for now, says LSI Logic chief financial officer D. Scott Mercer. This year, he has cut spending by 66%, down to around $60 million, anticipating pick-up to the $80 million to $100 million range in 1989.

So is Chrysler Corp.'s electronics assembly subsidiary: it bought some testers this year and is looking to add more. Computer-aided design and manufacturing equipment and surface-mount assembly equipment are also on plant manager Roger Rickey's shopping list. He expects to spend $40 million to $50 million over the next three or four years.

But are America's computer companies spending enough? Not according to Arthur D. Little Inc. analyst Jerry Wasserman. He evaluates a company's capital spending by comparing it with its net cash flow — the ratio of equipment spending to profits plus depreciation after dividends. Wasserman likes to see a 100% to 130% ratio, but in 1987, most of the big computer companies, for example, were nowhere near that ratio.

Wasserman speculates that they were watching the bottom line too closely. To compete against Japanese companies with their access to cheaper capital, managers in the United States must look further ahead, Wasserman insists. "We have got to have CEOs willing to stand up in front of the financial community and in front of their boards of directors," he says. "Unless they make the long-term investments, their companies are going to be buried." □

Top capital spenders

1987 rank	Company	Total capital expenditures ($ millions)	Percentage change in expenditures from 1986	Capital expenditures as a percentage of revenue	Capital expenditures to net cash flow after dividends	Total company revenue ($ millions)	Fiscal year ended
1	IBM	$4,304.0	-6.8%	7.9%	70.2%	$54,217.0	12/87
2	Xerox	937.0	-9.2%	9.1%	97.3%	10,320.0	12/87
3	DEC	748.4	32.6%	8.0%	47.6%	9,389.4	6/87
4	Unisys	720.9	30.3%	7.4%	75.4%	9,712.9	12/87
5	Motorola	658.0	11.0%	9.8%	91.5%	6,707.0	12/87
6	Hewlett-Packard	507.0	1.6%	6.3%	54.8%	8,090.0	10/87
7	GM Hughes Electronics	469.4	-33.0%	4.5%	56.1%	10,481.0	12/87
8	Texas Instruments	462.8	3.8%	8.3%	82.0%	5,594.5	12/87
9	NCR	389.2	7.9%	6.9%	62.4%	5,640.7	12/87
10	Honeywell	304.2	8.1%	4.6%	53.0%	6,679.3	12/87
11	Intel	301.5	94.8%	15.8%	86.9%	1,907.1	12/87
12	Pitney Bowes	251.8	20.6%	11.2%	88.9%	2,250.5	12/87
13	Litton Industries	242.8	-17.4%	5.5%	84.7%	4,419.7	7/87
14	Storage Technology	179.2	454.8%	23.9%	183.5%	750.0	12/87
15	Control Data	178.3	13.8%	5.3%	73.8%	3,366.5	12/87
16	LSI Logic	174.5	147.5%	66.6%	339.5%	262.1	12/87
17	AMP	171.8	13.3%	7.4%	57.6%	2,317.8	12/87
18	Amdahl	157.8	37.8%	10.5%	66.2%	1,505.2	12/87
19	Data General	142.9	10.1%	11.2%	576.1%	1,274.3	9/87
20	Tandem Computers	142.4	119.0%	13.7%	90.3%	1,035.5	9/87
21	Advanced Micro Devices	137.9	0.8%	13.8%	141.8%	997.1	12/87
22	Wang Laboratories	128.0	-45.2%	4.5%	42.8%	2,836.7	6/87
23	Compaq Computer	113.3	124.4%	9.3%	71.4%	1,224.1	12/87
24	Prime Computer	100.5	10.9%	10.5%	69.0%	960.9	12/87
25	National Semiconductor	94.7	-19.0%	5.1%	79.2%	1,867.9	5/87
26	Tandy	93.1	69.2%	2.7%	34.3%	3,452.2	6/87
27	Apple Computer	86.1	29.3%	3.2%	31.6%	2,661.1	9/87
28	Harris	83.6	-28.3%	4.0%	39.7%	2,079.0	6/87
29	Singer	78.7	-13.1%	4.1%	109.5%	1,902.7	12/87
30	Seagate Technology	78.4	102.7%	8.2%	46.8%	958.1	6/87
31	Sun Microsystems	76.1	110.2%	14.2%	124.0%	537.5	6/87
32	Perkin-Elmer	66.5	-2.9%	5.0%	492.2%	1,333.6	7/87
33	General Instrument	63.2	-13.8%	8.0%	103.7%	787.9	2/87
34	Microsoft	58.0	311.2%	16.8%	73.0%	345.9	6/87
35	Zenith Electronics	55.4	-9.2%	2.3%	247.3%	2,362.7	12/87
36	Apollo Computer	53.7	29.3%	9.7%	84.3%	553.7	12/87
37	E-Systems	51.1	7.0%	4.2%	68.3%	1,227.2	12/87
38	MiniScribe	50.5	139.5%	13.9%	128.2%	362.5	12/87
39	VLSI Technology	50.1	79.3%	29.1%	152.1%	172.0	12/87
40	Molex	49.5	23.3%	12.8%	65.2%	386.8	6/87
41	Gould	49.0	-14.3%	5.2%	51.2%	933.4	12/87
42	Avnet	47.3	109.7%	3.1%	146.5%	1,547.1	6/87
43	Varian Associates	46.2	-7.7%	4.7%	87.3%	982.8	9/87
44	Intergraph	43.7	-44.3%	6.8%	44.8%	641.1	12/87
45	Analog Devices	43.0	17.2%	11.6%	82.1%	370.4	10/87
46	Teradyne	41.0	34.9%	10.8%	374.1%	377.7	12/87
47	Tektronix	40.7	-40.5%	2.9%	30.2%	1,395.9	5/87
48	Western Digital	40.6	149.8%	8.8%	66.7%	462.5	6/87
49	Cray Research	40.2	-66.3%	5.8%	18.3%	687.3	12/87
50	Loral	34.2	-26.0%	5.0%	45.9%	690.0	3/87

Source: ELECTRONIC BUSINESS

(Continued)

Top capital spenders

1987 rank	Company	Total capital expenditures ($ millions)	Percentage change in expenditures from 1986	Capital expenditures as a percentage of revenue	Capital expenditures to net cash flow after dividends	Total company revenue ($ millions)	Fiscal year ended
51	AVX	$31.8	187.4%	11.7%	91.9%	$271.9	12/87
52	SCI Systems	29.6	172.1%	5.4%	104.8%	552.9	6/87
53	Augat	29.4	22.5%	9.4%	136.0%	313.2	12/87
54	Altos Computer	28.9	1,039.8%	18.8%	199.8%	153.9	6/87
55	Medtronic	28.4	469.6%	5.7%	32.3%	502.0	4/87
56	M/A-COM	26.7	-72.7%	6.1%	-295.1%	436.1	9/87
57	Lotus Development	26.6	71.1%	6.7%	30.3%	395.6	12/87
58	Applied Magnetics	25.7	148.4%	12.1%	98.8%	211.9	9/87
59	Datapoint	25.6	-2.8%	8.2%	-74.1%	312.1	7/87
60	Avantek	24.4	21.5%	11.4%	97.7%	213.7	12/87
61	Sprague Technologies	24.3	-38.2%	5.6%	76.2%	437.3	12/87
62	DSC Communications	23.2	21.5%	7.4%	53.5%	312.4	12/87
63	Micropolis	22.3	38.6%	7.7%	62.0%	288.3	12/87
64	Bolt Beranek and Newman	22.2	27.8%	9.5%	489.1%	233.8	6/87
65	Recognition Equipment	21.7	79.9%	8.2%	96.6%	264.7	10/87
66	Compugraphic	19.7	34.8%	5.4%	NA	367.1	12/87
67	Digital Communications	19.0	127.9%	10.5%	57.4%	181.4	6/87
68	Maxtor	17.4	125.8%	9.9%	66.1%	175.3	3/87
69	Cubic	17.1	98.6%	4.7%	118.8%	361.8	9/87
70	Oracle Systems	16.9	47.3%	12.9%	80.6%	131.3	5/87
71	Cherry Electrical	15.4	68.6%	9.6%	114.5%	160.6	2/87
72	General DataComm	15.3	-4.4%	7.6%	134.9%	200.6	9/87
73	Mentor Graphics	14.7	44.1%	6.6%	43.2%	221.8	12/87
74	Stratus Computer	13.8	-11.6%	7.5%	49.6%	184.2	12/87
75	LTX	13.6	156.0%	11.3%	283.6%	120.6	7/87
76	Kollmorgen	13.5	8.3%	4.5%	124.2%	301.0	12/87
77	CTS	13.4	-50.7%	5.1%	63.7%	261.1	12/87
78	MAI Basic Four	13.2	73.4%	4.1%	47.6%	321.0	9/87
79	Convergent	12.9	-62.8%	3.3%	NA	384.8	12/87
80	Dynatech	12.6	1.5%	4.1%	37.3%	304.7	3/87
81	Watkins-Johnson	12.3	-9.6%	4.7%	47.0%	264.3	12/87
82	Paradyne	12.2	-40.8%	5.2%	52.0%	232.6	12/87
83	Tandon	12.1	49.3%	4.2%	52.2%	289.1	12/87
84	Andrew	11.7	13.9%	5.2%	70.3%	223.2	9/87
85	GenRad	11.6	0.5%	6.0%	66.0%	193.8	12/87
86	Applied Materials	11.5	-0.4%	6.6%	119.6%	174.4	10/87
87	ADC Telecommunications	11.1	10.3%	6.7%	47.5%	166.9	10/87
88	Cullinet Software	11.0	-59.2%	6.3%	-124.9%	174.9	4/87
89	Dataproducts	11.0	20.8%	3.2%	60.2%	338.8	3/87
90	Gerber Scientific	10.6	49.6%	4.7%	41.4%	223.9	4/87
91	Westmark International	10.5	-37.4%	3.6%	366.7%	291.9	12/87
92	Computer Associates	10.4	71.2%	3.4%	16.4%	309.3	3/87
93	BRIntec	9.4	18.7%	3.2%	73.5%	293.7	12/87
94	Genicom	9.4	105.6%	3.1%	37.8%	302.2	12/87
95	Marshall Industries	9.2	-14.8%	3.2%	143.7%	286.6	5/87
96	Micom Systems	9.1	8.1%	4.6%	45.7%	196.7	3/87
97	ISC Systems	8.8	29.3%	5.2%	68.4%	168.5	6/87
98	Coherent	8.5	-4.4%	5.3%	222.4%	159.0	9/87
99	Diebold	8.4	-43.3%	1.9%	29.7%	439.1	12/87
100	Fluke	8.3	-8.3%	4.0%	66.9%	206.3	9/87

Source: ELECTRONIC BUSINESS

(Continued)

Top capital spenders by segment

Capital expenditures
FY 1987

Semiconductors

	Total ($ millions)	As a percentage of revenue
Motorola	$658.0	9.8%
Texas Instruments	462.8	8.3%
Intel	301.5	15.8%
LSI Logic	174.5	66.6%
Advanced Micro Devices	137.9	13.8%
National Semiconductor	94.7	5.1%
Harris	83.6	4.0%
VLSI Technology	50.1	29.1%
Gould	49.0	5.2%
Analog Devices	43.0	11.6%
Western Digital	40.6	8.8%
International Rectifier	6.0	4.0%
Total, weighted avg.	**$2,101.7**	**9.8%**

Communications

	Total ($ millions)	As a percentage of revenue
Motorola	$658.0	9.8%
General Instrument	63.2	8.0%
M/A-COM	26.7	6.1%
Avantek	24.4	11.4%
DSC Communications	23.2	7.4%
Bolt Beranek and Newman	22.2	9.5%
Digital Communications	19.0	10.5%
General DataComm	15.3	7.6%
Dynatech	12.6	4.1%
Paradyne	12.2	5.2%
Andrew	11.7	5.2%
ADC Telecommunications	11.1	6.7%
Micom Systems	9.1	4.6%
Scientific-Atlanta	6.7	1.4%
3Com	6.3	5.7%
TIE/communications	4.3	1.7%
Aydin	4.1	2.8%
Dynascan	1.7	0.9%
Total, weighted avg.	**$931.8**	**8.2%**

Minicomputers

	Total ($ millions)	As a percentage of revenue
IBM	$4,304.0	7.9%
DEC	748.4	8.0%
Hewlett-Packard	507.0	6.3%
Data General	142.9	11.2%
Tandem Computers	142.4	13.7%
Prime Computer	100.5	10.5%
Sun Microsystems	76.1	14.2%
Apollo Computer	53.7	9.7%
Gould	49.0	5.2%
Stratus Computer	13.8	7.5%
MAI Basic Four	13.2	4.1%
Computer Consoles	4.9	3.3%
Total, weighted avg.	**$6,155.9**	**7.9%**

Office equipment

	Total ($ millions)	As a percentage of revenue
IBM	$4,304.0	7.9%
Xerox	937.0	9.1%
NCR	389.2	6.9%
Pitney Bowes	251.8	11.2%
Wang Laboratories	128.0	4.5%
Harris	83.6	4.0%
Datapoint	25.6	8.2%
Diebold	8.4	1.9%
Savin	1.2	0.3%
Total, weighted avg.	**$6,128.7**	**7.8%**

Mainframes

	Total ($ millions)	As a percentage of revenue
IBM	$4,304.0	7.9%
Unisys	720.9	7.4%
NCR	389.2	6.9%
Control Data	178.3	5.3%
Amdahl	157.8	10.5%
Cray Research	40.2	5.8%
Total, weighted avg.	**$5,790.4**	**7.7%**

Components

	Total ($ millions)	As a percentage of revenue
AMP	$171.8	7.4%
Molex	49.5	12.8%
AVX	31.8	11.7%
Augat	29.4	9.4%
Sprague Technologies	24.3	5.6%
Cherry Electrical	15.4	9.6%
CTS	13.4	5.1%
BRIntec	9.4	3.2%
Oak Industries	6.2	3.4%
Total, weighted avg.	**$351.2**	**7.6%**

Software

	Total ($ millions)	As a percentage of revenue
Microsoft	$58.0	16.8%
Lotus Development	26.6	6.7%
Oracle Systems	16.9	12.9%
Mentor Graphics	14.7	6.6%
Cullinet Software	11.0	6.3%
Computer Associates	10.4	3.4%
Ultimate	7.9	4.6%
Ashton-Tate	6.5	2.4%
Total, weighted avg.	**$152.1**	**7.5%**

Microcomputers

	Total ($ millions)	As a percentage of revenue
IBM	$4,304.0	7.9%
Compaq Computer	113.3	9.3%
Tandy	93.1	2.7%
Apple Computer	86.1	3.2%
Zenith Electronics	55.4	2.3%
Altos Computer	28.9	18.8%
Tandon	12.1	4.2%
AST Research	6.3	3.0%
Atari	4.1	0.8%
Total, weighted avg.	**$4,783.3**	**7.2%**

Peripherals

	Total ($ millions)	As a percentage of revenue
Storage Technology	$179.2	23.9%
Control Data	178.3	5.3%
Seagate Technology	78.4	8.2%
MiniScribe	50.5	13.9%
Applied Magnetics	25.7	12.1%
Micropolis	22.3	7.7%
Maxtor	17.4	9.9%
Tandon	12.1	4.2%
Dataproducts	11.0	3.2%
Genicom	9.4	3.1%
Wyse Technology	8.1	3.1%
AST Research	6.3	3.0%
Quantum	5.9	4.9%
Cipher Data Products	5.8	3.3%
Decision Industries	4.9	2.6%
Intelligent Systems	2.8	1.7%
Xidex	2.2	0.4%
Total, weighted avg.	**$620.2**	**7.1%**

Government

	Total ($ millions)	As a percentage of revenue
Motorola	$658.0	9.8%
GM Hughes Electronics	469.4	4.5%
Texas Instruments	462.8	8.3%
Honeywell	304.2	4.6%
Litton Industries	242.8	5.5%
Harris	83.6	4.0%
Singer	78.7	4.1%
E-Systems	51.1	4.2%
Gould	49.0	5.2%
Varian Associates	46.2	4.7%
Loral	34.2	5.0%
SCI Systems	29.6	5.4%
Cubic	17.1	4.7%
Watkins-Johnson	12.3	4.7%
Aydin	4.1	2.8%
Logicon	3.8	1.9%
Total, weighted avg.	**$2,547.0**	**5.9%**

Capital equipment

	Total ($ millions)	As a percentage of revenue
Hewlett-Packard	$507.0	6.3%
Perkin-Elmer	66.5	5.0%
Varian Associates	46.2	4.7%
Teradyne	41.0	10.8%
Tektronix	40.7	2.9%
LTX	13.6	11.3%
GenRad	11.6	6.0%
Applied Materials	11.5	6.6%
Gerber Scientific	10.6	4.7%
Fluke	8.3	4.0%
Sun Electric	4.6	2.3%
Esterline	2.7	1.0%
Total, weighted avg.	**$764.3**	**5.6%**

Computer-based systems

	Total ($ millions)	As a percentage of revenue
Hewlett-Packard	$507.0	6.3%
Honeywell	304.2	4.6%
Intergraph	43.7	6.8%
Recognition Equipment	21.7	8.2%
Gerber Scientific	10.6	4.7%
ISC Systems	8.8	5.2%
Coherent	8.5	5.3%
Measurex	6.9	3.0%
Sun Electric	4.6	2.3%
Total, weighted avg.	**$916.0**	**5.5%**

Medical

	Total ($ millions)	As a percentage of revenue
Medtronic	$28.4	5.7%
Westmark International	10.5	3.6%
Diasonics	8.1	3.0%
Total, weighted avg.	**$47.0**	**4.4%**

Distributors

	Total ($ millions)	As a percentage of revenue
Avnet	$47.3	3.1%
Marshall Industries	9.2	3.2%
Wyle Laboratories	3.8	1.0%
Pioneer-Standard	2.3	1.1%
Arrow Electronics	2.2	0.4%
Anthem Electronics	0.9	0.5%
Total, weighted avg.	**$65.7**	**2.1%**

Source: ELECTRONIC BUSINESS

Stop harping about Japan's electronics prowess

In terms of productivity, sales and net income growth, the top U.S. electronics firms outperformed their Japanese rivals last year

BY PAULA DOE

After two hard years, Japan's major electronics producers are starting to see results from their efforts to cope with the high-valued yen. Sales of the top 20 electronics companies in Japan revived to a healthy 9.9% growth rate for the fiscal year ended March 1988. And net income for the same group of companies surged 35.4% during the same time period.

Nonetheless, U.S. companies did better across the board (see accompanying table). Although sales of the leading U.S. electronics producers only slightly outpaced those of their Japanese counterparts, net income grew significantly faster. The top 20 U.S. electronics companies' net income surged 48.1% last year. The U.S. companies' aggregate net income was 7.5% of sales, roughly three times the Japanese percentage.

ELECTRONIC BUSINESS tracks the consolidated financial results for the 20 largest electronics companies in Japan. The Japanese figures (see accompanying table) are then compared against those from the top 20 U.S. electronics companies from our ELECTRONIC BUSINESS 200 listing, published in our July 15th issue.

In spite of Japan's intense efforts to improve productivity during the past couple of years, the U.S. sector made greater gains. While Japanese sales per employee were up 10.1%, the top 20 U.S. companies saw 12.4% improvement. And in terms of net income per employee, the Japanese growth of 38.1% was outpaced by the U.S. increase of 48.4%. In fact, U.S. productivity growth has been significantly higher for each of the past three years since ELECTRONIC BUSINESS began compiling these figures.

Revenue and earnings per employee are crude ways to compare productivity, since they reflect market forces as well as output. However, better measures are hard to come by and, whatever the actual levels, the rate of change in revenue and earnings per employee still suggest a general trend in productivity growth.

While the United States is increasing its productivity faster than Japan, the Japanese appear to still be more productive. The average Japanese revenue per employee of $211,400 was twice that of the United States. Still, the revenue-per-employee figures for Japan are artificially inflated by the web of affiliated firms that surrounds the major Japanese electronics corporations. Although the parent corporation's relationship with its affiliated supplier or distributor may be close, the parent typically does not own a high percentage of the affiliate, so the affiliate's workers are not counted in the parent's consolidated total of employees.

Furthermore, the Japan revenue-per-employee figures also looked huge last year because of the appreciation of the yen against the dollar.

Rod Thomas

In actuality, the figures for the top Japanese companies remain at only about 55% of their peak levels of 1984. U.S. revenue per employee, on the other hand, is up 16% from 1984.

Revenue figures aside, the U.S. top 20 far outpace their Japanese rivals in terms of income productivity. The average net income per employee figure for Japan was only $5,000, much less than the U.S. average of $7,900.

Kudos for the Japanese

Still, the Japanese deserve kudos for riding out the wild fluctuations in their currency. Japanese sales growth last year almost caught back up with U.S. levels. The 9.9% growth in yen-based electronics revenue at the big Japanese producers approached the 12.5% increase at the top 20 U.S. producers. In sharp contrast, Japanese sales two years ago were flat as the high yen devastated export sales. U.S. companies maintained 4% to 5% growth that year. The 9.9% growth in electronics sales outpaced the 7.1% increase in total sales at the Japanese companies, as producers began to successfully move to higher value-added products — fewer toasters and fans, more computers and VCR camcorders.

Mitsubishi Electric Corp. led the Japanese recovery last year with a dramatic 55% increase in electronics revenue. Oki Electric Industry Company Ltd. also made a significant comeback with a 19% sales growth, after a rough year in 1986. Fujitsu Ltd. saw an impressive 14% increase in revenue, while NEC Corp. and Omron Tateisi Electronics Co. both saw 11% growth in overall sales. On the other hand, Hitachi Ltd. experienced a 6% decline in electronics revenue, but the company's total sales increased 3%. Sanyo Electric Company Ltd. saw its sales dip 14%.

With growth reviving and the yen strengthening against the dollar, the leading Japanese electronics producers look bigger and bigger. The top seven companies in Japan now have electronics sales exceeding $10 billion each. To make last year's top 20 list, a company had to have electronics sales of at least $2 billion. In fact, total sales of the Japanese top 20 are now 15% more than those of the 20 largest U.S. producers, and come to some 58% of those of the total ELECTRONIC BUSINESS 200.

In addition to revenue, earnings for the Japanese also started to recover after plummeting in each of the past two years. Thanks to intensive cost cutting efforts, companies reported big percentage increases in earnings last year, although margins still remain extremely thin. Net income was up 35.4%, but remained a meager 2.6% of sales, reflecting no change from the 2% to 3% of the last several years.

A 579% growth

Of the Japanese top 20, Omron had the most impressive earnings gain. The company's net income last year swelled 579% to $166 million. Oki experienced a 144% surge in net income to $40 million. Mitsubishi saw a 110% gain. Sanyo, however, reported a net income loss of $140 million. The Osaka-based corporation, heavily dependent on exports, was

Japanese versus U.S. electronics companies in 1987*

	Japanese top 20	U.S. top 20
Electronics revenue ($ billions)	$173.1	$151.5
Change from 1986	+9.9%	+12.5%
Total revenue ($ billions)	$275.3	$154.2
Change from 1986	+7.1%	+12.2%
Net income ($ billions)	$6.8	$11.5
Change from 1986	+35.4%	+48.1%
Net income/sales	2.6%	7.5%
Revenue per employee	$211,400	$105,734
Change from 1986	+10.1%	+12.4%
Net income per employee	$5,000	$7,898
Change from 1986	+38.1%	+48.4%

Conversion rate: ¥ 125 = $1

* For Japanese companies, fiscal year ended March 1988

Source: ELECTRONIC BUSINESS

the only major Japanese electronics company to lose money last year.

Only a very few of the most successful companies managed to earn more than 10 cents on the dollar from operations and more than 4 cents in net income. Nippon Telegraph and Telephone Corp., with its lucrative domination of the telecommunications market in Japan, had operating income of 15% of revenue and net income of 4%. Kyocera Corp., with its domination of the worldwide ceramic package market, had operating income of 14% of sales, and net of 7.5%. Kyocera recently forecast a 23.4% increase in pretax recurring profits for the current fiscal year. TDK Electronics Company Ltd. also maintained its relatively healthy bottom line with operating income of 12% and net of 4.5%.

Everybody else had operating income amounting to 5% of sales or less, and net income of 3% or less. Reliable consolidated figures for other measures of return, such as return on equity or return on investment, were not yet available for most of the Japanese companies. □

Japan's top electronics companies in 1987

		Electronics revenue ($ millions)	Total revenue ($ millions)	Net income ($ millions)	Net income as a percentage of revenue	Revenue per employee	Net income per employee	Fiscal year ended
1	**Matsushita**[1]	$28,500	$38,552	$1,303	3.4%	$285,600	$9,600	3/88
	Change from 1986	11%	5%	-0.5%	—	—		
2	**NEC**	21,700	21,718	203	0.9%	212,000	2,000	3/88
	Change from 1986	11%	11%	69%	—	—	—	
3	**Toshiba**	17,100	28,579	486	1.7%	234,000	4,000	3/88
	Change from 1986	13%	8%	78%	—	—	—	
4	**Hitachi**	16,600	39,081	1,094	2.7%	248,900	6,800	3/88
	Change from 1986	-6%	3%	39%	—	—	—	
5	**Fujitsu**[2]	16,400	16,374	337	2.1%	172,700	3,600	3/88
	Change from 1986	14%	14%	95%	—	—	—	
6	**Sony**[1]	11,700	11,655	294	2.5%	192,600	4,900	3/88
	Change from 1986	10%	10%	-12%	—	—	—	
7	**Mitsubishi**[1]	11,400	18,946	178	0.9%	256,000	2,400	3/88
	Change from 1986	55%	12%	110%	—	—	—	
8	**Sharp**[2,3]	8,100	9,880	160	1.6%	184,700	3,000	3/88
	Change from 1986	12%	8%	-4%	—	—	—	
9	**Canon**	7,300	7,814	106	1.3%	208,200	2,800	12/87
	Change from 1986	8%	10%	24%	—	—	—	
10	**Sanyo**	5,700	9,491	-140	-1.5%	233,800	-3,500	11/87
	Change from 1986	-14%	0%	-933%	—	—	—	
11	**Ricoh**[3]	4,400	5,200	110	2.2%	185,700	4,000	3/88
	Change from 1986	11%	10%	28%	—	—	—	
12	**Oki**[3]	3,900	3,880	40	1.1%	192,600	2,100	3/88
	Change from 1986	19%	19%	144%	—	—	—	
13	**TDK**	3,200	3,186	145	4.5%	199,100	9,000	11/87
	Change from 1986	5%	3%	17%	—	—	—	
14	**Pioneer**	2,900	2,924	91	3.1%	225,000	7,000	3/88
	Change from 1986	3%	5%	111%	—	—	—	
15	**NTT**[2]	2,900	45,296	1,946	4.3%	155,600	6,700	3/88
	Change from 1986	8%	6%	64%	—	—	—	
16	**Alps**[2]	2,800	2,964	66	2.2%	197,600	4,400	3/88
	Change from 1986	0%	0%	107%	—	—	—	
17	**Omron**	2,400	2,414	166	2.6%	166,500	11,400	3/88
	Change from 1986	8%	11%	579%	—	—	—	
18	**Kyocera**	2,100	2,403	181	7.5%	150,200	11,300	3/88
	Change from 1986	12%	9%	30%	—	—	—	
19	**Citizen**[2,3]	2,000	2,200	40	1.8%	262,800	4,700	3/88
	Change from 1986	7%	4%	46%	—	—	—	
20	**Casio**[3]	2,000	2,040	40	1.8%	264,200	4,700	3/88
	Change from 1986	7%	12%	57%	—	—	—	

Conversion rate: ¥125 = $1

[1] Comparisons are with the company's last full fiscal year, ending 11/86 for Matsushita and 10/86 for Sony. Both companies recently changed their fiscal year and released only partial results for the period ending 3/87

[2] Consolidation by Japanese accounting conventions, which differ from U.S. Securities and Exchange Commission rules

[3] Preliminary figures before release of final consolidated results

Source: ELECTRONIC BUSINESS

What U.S. companies need to do Down Under

Through Australia's corporate partnership plan, U.S. computer companies must reach specific goals for local R&D and export

BY CRAIG ADDISON

Wanted: Foreign electronics companies to become "corporate partners." No experience necessary, just a commitment to R&D and export. Renumeration in the form of lucrative government contracts. Apply immediately to the Australian government.

And apply they have. In the 10 months since the government introduced its corporate partnership plan, overseas computer companies have been signing up at the rate of one a month. By becoming corporate partners, these companies are exempt from the government's offsets obligations, which require that 30% of the value of government contracts be sourced locally.

To qualify for the tag "corporate partner," a foreign company must spend 5% of its annual Australian turnover on local R&D and match the value of its imports with exported products. The partner must meet both stipulations within seven years, a challenge indeed for the Australian subsidiaries of U.S.-owned computer corporations that in the past have really only been shop fronts.

These "Partnerships for Development Agreements," as they are officially called, are the cornerstone of the Australian government's plan to stem a $3.2 billion a year trade deficit in information technology products. Under its Information Industries Strategy, the government has set a target of $1.2 billion in annual exports by 1995, and on paper it is well past the halfway mark, thanks to the export commitments of the country's foreign corporate partners.

To date, 10 multinational corporations have signed on the dotted line: Apollo Computer Inc., Apple Computer Inc., Cincom Systems Inc., Digital Equipment Corp., Hewlett-Packard Co., Honeywell Bull Inc., IBM, Sun Microsystems Inc., Unisys Corp., and Wang Laboratories Inc. If they meet their stated goals, these 10 will have eased the Australian balance of trade by $780 million by 1994 [see accompanying table]. In the same time frame, the companies will have reached a combined local R&D level of $174 million a year.

So far, U.S. computer companies dominate the corporate partnership ranks, but NEC Corp. is expected to become the first Japanese corporation to sign up. Other firms that are aiming for corporate partnership status include ICL Plc of Britain, Memorex Telex, Fujitsu Ltd. of Japan, NCR Corp. of the United States and West Germany's Siemens AG.

The Australian government has taken a hands-off approach, letting its corporate partners decide for themselves where to spend the money. However, bureaucrats and politicians are hoping that the program will encourage multinational companies to center their Pacific basin operations in Australia. Many of the companies, including Hewlett-Packard, IBM and Unisys, have chosen software development as the major component of their partnership activities. Others, such as Apollo's Australian subsidiary are channeling their R&D activities through locally owned companies.

Although the corporate partnership scheme is only in the embryonic stage, the government has declared it a great success. Mike Fitzpatrick, first assistant secretary of the light industries division in the Department of Industry, Technology and Commerce (DITAC), is confident that the existing rate of one new partner a month will be maintained

John Heaton/Stock Boston

throughout the near future.

Now that the government has signed up most of the major U.S. computer hardware companies, Fitzpatrick says international software firms are on the hit list. After that, communications equipment suppliers will be the next target.

Tipping the balance

As well as tipping the balance of trade by encouraging multinationals to export from Australia, the corporate partnership plan is designed to give Australian-owned companies access to world electronics markets. A number of small indigenous firms have already benefited by jumping into bed with foreign corporations.

Pulsar Electronics Pty Ltd., a small computer design company, has teamed up with Honeywell Bull in a deal that opens export doors for the Melbourne-based firm. As well as selling thousands of Pulsar workstations to Telecom Australia, Honeywell Bull is manufacturing the workstation processors in Sydney and plans to ship the product to other countries. Pulsar has a good track record when it comes to designing innovative products, but has suffered setbacks in trying to penetrate world markets, a typical plight of many Australian electronics companies.

Another Australian firm that has broken into high-volume overseas sales thanks to a corporate partner is LSE Manufacturing Pty Ltd. of Sydney. The small printed circuit board assembly company is shipping loaded and fully tested boards to Apple's Singapore factory. The deal will boost LSE's annual sales by $4.8 million, but that's only the beginning. A second contract with corporate partner Apple Computer Australia will see LSE manufacturing a further 30,000 boards a month.

The partnership scheme is also expected to create thousands of new jobs over the next several years. But this anticipated increase has many executives from Australia's electronics companies worried. In an industry already suffering from shortages of skilled technical staff, several such executives are wondering where the multinationals are going to find capable employees.

Some local companies are afraid that their small R&D labs may become hunting grounds. The Australian Computer Equipment Manufacturers Association (ACEMA) recently surveyed more than 30 of its members and has already found "strong indications of poaching by transnational companies," according to Don Dryden, president of the group. Dryden's own company, Labtam Ltd., is one of the biggest R&D spenders in the indigenous industry, with an R&D staff of 30 employees and an annual budget of $1.6 million. He is concerned that corporate partners like IBM Australia Ltd., with a commitment to eventually spend more than $60 million a year on R&D, could wipe out the local R&D industry overnight if it recruited staff within Australia.

The corporate partner plan could, however, create a labor shortage

Indeed, an overheated job market would push up labor costs, according to Peter Rehn, general manager of Computer Sciences of Australia. He argues that, particularly in markets where margins are low, local companies could go out of business if labor rates increase substantially.

Government officials say they are addressing the people problem by working to increase substantially university enrollment in technical fields. However, for the short term, the plan is to carry out retraining courses to increase the skills of people already working in industry, and to relax Australian immigration laws to attract qualified overseas workers.

Hewlett-Packard Australia Ltd. has estimated that its partnership activities will create more than 300 new jobs, but denies the need to poach from local companies. "We have access to a worldwide network of people. We don't have to steal from the 'little Aussie battler,' " contends HP Australia's managing director Malcolm Kerr. "If anything, we give more people to local industry than we take from them."

While the corporate partnership program has been hailed by many, the plan does have its critics. Richard May, a former Australian government trade commissioner and now a computer industry consultant, believes the root of the problem lies with the attitudes of government purchasing officers. "We have to get out of the mold of thinking that imported products are better," he says. May argues that Australia should emulate the policies of the United States, Canada, West Germany and others, in giving preference to indigenous companies. He adds that the corporate partnership scheme was just an attempt by the government to get foreign multinationals to solve the country's balance of trade problem. □

Conversion rate: U.S. $1 = Australian $1.24

Australia's corporate partnership program

Company	Annual local R&D* ($ millions)	Annual Australian exports* ($ millions)	Major partnerships; activities
Apple Computer	$14.5	$86.3	Transfer of manufacturing technology; joint R&D programs
Apollo	NA	8.1	Joint ventures in niche computer products
Cincom Systems	NA	37.9	Software development; education/client services
DEC	20.2	80.6	Computer communications products; software development
Hewlett-Packard	17.7	62.9	Fourth generation languages; computer communications products
Honeywell Bull	8.1	40.3	EFT/POS equipment, education/training services; Asian/Pacific board repairs
IBM	60.5	274.2	Software development; PC manufacturing; education/technical services
Sun Microsystems	7.2	28.2	Technology transfer; software/hardware development; training services
Unisys	28.2	104.8	Software development; education/training services
Wang	17.3	56.4	Encryption systems; joint ventures
Total	$173.7	$779.7	

Conversion rate: Australian $1.24 = U.S. $1

* Amount to be achieved by 1993-1994

Source: ELECTRONIC BUSINESS

SCL in India: A passage to semiconductors

As India's economy moves toward capitalism, Semiconductor Complex Ltd. ramps production up to satisfy a budding electronics industry

BY RAJU CHANDRASEKAR

Virendra Mohan could well be called the maharajah of India's chip industry. Chairman and CEO of Semiconductor Complex Ltd., located in Chandigarh, near New Delhi, Mohan has managed to bring on line a $50 million fab which currently manufactures 2 million semiconductors monthly. "This," he boasts, "is in the same country where still an efficient bullock cart is being designed."

SCL's accomplishments are indicative of India's growing presence in the worldwide electronics industry. The country's electronics production surged 21.7% to $3.7 billion in its latest fiscal year ending last March, according to market research firm Dataquest Inc. of San Jose. In regard to components, including semiconductors, production grew 9.4% to $477 million during the same time period.

Admittedly, SCL's large-scale integration chip fab pales when compared to those in the United States and Japan. But Mohan discloses an aggressive plan to reach VLSI (very large-scale integration) levels soon. According to him, SCL is spending $15 million to implement a pilot line for 3-micron to 2-micron geometries and the company will achieve 1.2-micron capability by 1989. Because SCL's order book is full for the next 12 months, Mohan plans to double his fab's production during 1989.

Spending 30% of sales on R&D, Mohan's goal is to migrate from calculator and watch semiconductors to more advanced chips such as ASICs. SCL has plans for 10 chip-design centers to be scattered throughout India's major high-tech regions. To acquire the technology to move upmarket, Mohan is very keen on establishing joint ventures with U.S. partners.

The AMI connection

From the beginning, Mohan has had experience with Yankees. SCL's fab was actually set up five years ago by the Indian government with help from American Microsystems Inc. (AMI) of Santa Clara, Calif., which was subsequently bought out by Gould Inc. SCL started off by building chips from AMI's designs.

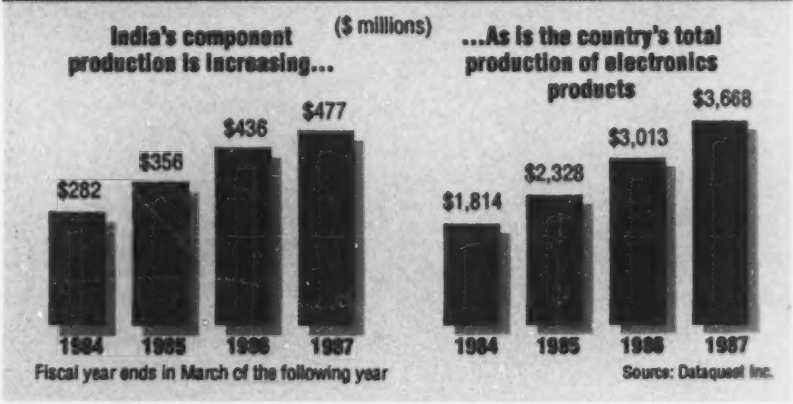
Not surprisingly, SCL's fab — which houses the capability to do mask making, wafer fabrication, assembly, packaging and testing all under the same roof — has a definite American flavor. Currently run with 800 employees, the plant uses production and test equipment purchased from Eaton Corp., EG&G Inc., Fairchild Camera and Instrument Corp. (acquired by Schlumberger Ltd.), GCA Corp., and Varian Associates.

At the outset, SCL's plans to pump $50 million into a chip fab were considered brash. However, the company's risky strategy seems to be paying off. After losing money the first few years of operation, SCL reported cash profits on revenue of $15 million in its most recent fiscal year, ended last March.

And revenue could surge in the future as the Indian government begins pumping money into expanding the country's telecommunications industry. Government officials have announced plans to invest $30 billion to implement 16 million more phone lines by the turn of the century. Because of its indigenous origins, SCL gets preferential treatment from the Indian government, which has already proved valuable in winning defense-related work. The defense semiconductor market in India, roughly estimated at around $200 million this year, is believed to be double that of its civilian counterpart.

In addition, SCL stands to benefit from rising labor costs in the Pacific Rim. India's 60 cents per hour wage for electronics equipment operators is among the world's lowest. The comparable labor figures for South Korea, Taiwan and Thailand are $2.50, $2 and $1.15, respectively. □

India's electronics production



PCs make it easier to collect and analyze data

Standalone data acquisition products are giving way to personal computer-based systems that not only log information, but make sense of it as well

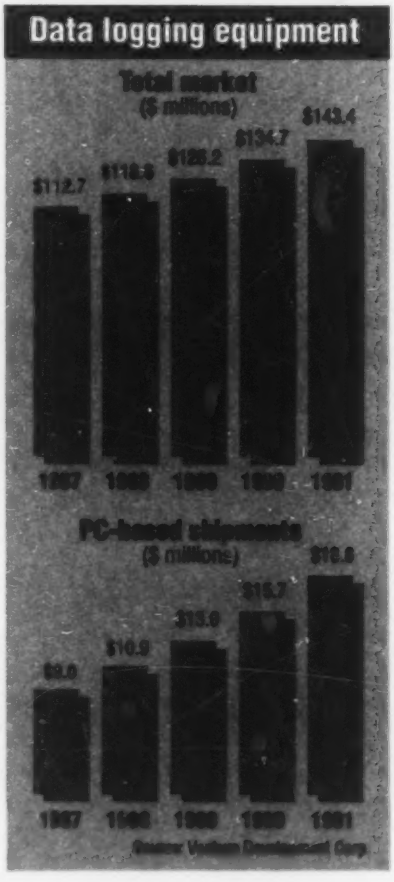
BY SYLVIA TIERSTEN

For many years, standalone data loggers have measured such factors as temperature, pressure and speed of products and processes in the laboratory and on the factory floor. Then came the personal computer. Suddenly, data logging was more than a routine check of routine functions. PC-based systems not only take numerical measurements; they analyze the data as well. And they do it without a big, expensive mainframe.

"People who are already drowning in numbers don't want more numbers; they want information," explains James Pinto, president of Action Instruments Inc., a San Diego-based manufacturer of data acquisition systems. "They want a readout that says, 'Please check boiler seven.'"

As a result, demand for PC-based data acquisition hardware and software is expected to grow an average of 20.8% a year through 1991, according to Venture Development Corp., a Natick, Mass., market research firm. By then, PC-based systems will account for about $18.8 million of a total $143.4 million market. By contrast, Venture Development predicts that in the same period, demand for standalone data loggers will increase less than 2% a year in dollars — from $59.6 million last year. Actual unit volume, however, will rise about 5%, because shipments of lower priced, hand-held data loggers will dominate.

It's not just former users of standalone devices that are buying sophisticated PC-based equipment. Operations that have relied on costly mainframe and minicomputer-based data collection systems also are interested in the price/performance characteristics of the PC entries. PC-based data collection and display systems cost an average of $8,000 to $10,000 today, according to Automation Research Corp., a Medford, Mass., market analysis firm. This price includes a microcomputer; a coprocessor for handling data in real time; monitor; interfaces; I/O boards; and data acquisition software. And if software packages decline from $2,500 in 1988, to $1,500 in 1991, as Automation Research's project director Dan Cretu anticipates, overall system costs will decline as well.



Right now, though, "It's a fairly competitive market price-wise," says Robert Judd, marketing vice president for MetraByte Corp., a Taunton, Mass., maker of plug-in boards and PC-compatible external systems. In recent years, prices and gross profit margins on boards (from 40% to 60%) have been "roughly maintained," he says. "If you can make 10% after taxes, you are doing very well." Pinto considers 90% for software and 50% for hardware "reasonable gross margins" but suspects that "some people are getting 20% on hardware and 30% to 40% on software."

PCs not perfect

Standalone equipment, meanwhile, ranges from $300 to $10,000. At the high end of the standalone market are products that offer more accuracy and faster sampling rates than PC-based technology. "In the PC arena you can't sample at gigahertz rates," says Melodie Summersett, national sales manager for National Instruments, an Austin, Texas-based vendor of IEEE-488 instrument control. Low-end data loggers "are viable if people have them already," says Summersett, and they will eventually give way to PCs. To stay in data acquisition, he says "it looks like a lot of vendors of traditional data loggers will also offer board-level solutions."

Environmental conditions sometimes preclude use of a PC-based system. Disk drives, for instance, may have difficulty withstanding excessive heat or vibration. Despite an emerging market for hardened, battery powered personal computers that can survive in a wide temperature range, "you still find simple-to-use data acquisition tools without a keyboard in these environments," says David Postetter, data acquisi-

tion marketing manager for John Fluke Manufacturing Company Inc., Everett, Wash. But many of these systems, unlike their earlier counterparts, produce files that may be transferred to a PC for analysis and report generation.

Today's PC-based data collection market is populated with small, start-up software companies, makers of plug-in I/O boards for personal computers, and control and instrumentation vendors who have branched out from dedicated data loggers to PC-controlled devices. On the software side, Lotus Development Corp. recently exited from data acquisition by selling its Lotus Measure package to National Instruments.

Measure, a PC-based software system for scientific applications requiring data capture and instrument control, includes a set of drivers for Lotus 1-2-3 and Symphony that permits acquisition, formatting and storage of data directly into the spreadsheet. For the maker of general purpose spreadsheets, the anticipated volume simply wasn't there.

Various options

Adapting the PC to the data acquisition operation can be accomplished in one of three ways. Least expensive is the printed circuit board level product with a rear connector for attaching input and output signals. Another approach, expansion chassis architecture, has the PC connected by cable to a separate "box" that holds the data acquisition I/O modules. Some are fully controlled by the PC, while others are "intelligent" and contain microprocessors.

A third option is to place digital logic and digital-to-analog converters on a plug-in card that is attached to a box via a cable. Electrically sensitive functions, including signal connection and conditioning, and analog-to-digital conversion, are performed in the external box.

The option card market is somewhat "price sensitive, since there is a maximum perceived price for anything that plugs into a PC," notes George Nadzam, marketing manager for the Data Acquisition and Control Division of Keithley Instruments Inc.

PC data collection sales will grow almost 21% a year through 1991

While until now, PC-based data acquisition applications have been centered within the laboratory research community, they are now headed for the factory floor. Laboratory Technologies Corp., for instance, a Wilmington, Mass., firm, named itself and its Labtech software line for its initial target market. Three years ago, recalls company president Frederick A. Putnam, "our sales were 60% academic research lab and 40% industrial research lab. Academics tend to be early adopters of new technology." Now, Putnam estimates, the ratio has shifted to 30% academic and 70% mainline industrial research. The next step, he anticipates, is the move of PC-based data acquisition systems from the industrial laboratory to the factory floor to bolster quality control.

Automation Research's Cretu sees the laboratory sector for PC-based data capture as "pretty well saturated." Data gathering for plant management, formerly the province of the minicomputer, is a potential growth area. But the hottest up and coming sector, he thinks, is in shop floor data collection and control.

Once a software user obtains diagnostic information, such as the number of vibrations per second and machine failures, "the next level of utility is event control," notes Action Instruments' Pinto. He estimates that 20% of the time his company's CIMPAC software package is used for controlling purposes in addition to data capture and analysis.

With few exceptions, PC-based data acquisition software products tend to be generic rather than application or industry specific. The market is "extremely broad and cuts across all disciplines and industries," says Putnam, including aerospace, automotive, chemical, medical, semiconductor and general manufacturing. What chiefly inhibits market growth, he thinks, is that "users of oscilloscopes and chart recorders have to be converted to doing something a different way." □

PC-based data logging now comes in two flavors

Until recently, you could have any operating flavor you wanted in the PC-based data acquisition world — as long as that flavor was DOS. Now, it appears, users have a choice beween IBM-compatible and Macintosh environments.

Some vendors, such as World Precision Instruments Inc. in New Haven, Conn., are specifically targeting scientific and engineering users of Apple Computer Inc.'s Macintosh. World Precision makes MacLab, a hardware/software data acquisition package that replaces storage oscilloscopes and polygraphs. The hardware unit can be linked to the modem port of any Macintosh computer.

Several vendors of IBM-compatible products are hedging their bets by creating Macintosh versions of existing lines. Laboratory Technologies Corp. of Wilmington, Mass., for instance, recently unveiled a Mac-based modification of Notebook, its IBM-based data acquisition program for scientific research and industrial process control.

Asyst Software Technologies Inc. of Rochester, N.Y., a wholly owned subsidiary of Keithley Instruments Inc., currently confines itself to the IBM world, but is weighing the merits of taking on the Big Apple. "We feel that the Macintosh is gaining share in the laboratories," notes company president and CEO Hermann Hamm. Eighteen months from now, he predicts, 80386-based PCs and Mac IIs will dominate the PC-based data acquisition market.

"We have noticed in our business that Mac IIs are replacing some of the Digital Equipment Corp.'s business," says Melodie Sunmersett at National Instruments in Austin, Texas. Hewlett-Packard Co. users, who shied away from the IBM-PC world, "are moving toward the MAC because they feel comfortable with the user interface." □

Hybrid circuit vendors size up the MMIC challenge

New defense demands and potential satellite markets mean good growth in MMIC chips. Hybrid makers are tuning in

BY JAN MURPHY

The makers of hybrid microwave integrated circuits (HMICs) are facing tactical changes in their military and commercial markets — changes caused by gallium arsenide semiconductor technology.

Analysts say that HMIC manufacturers are now facing an expensive shift away from using discrete components in HMICs to using monolithic microwave integrated circuits (MMICs), which are being manufactured as gallium arsenide-based chips. As the technology develops, MMIC chips will eventually reduce the overall cost of HMICs. Yet the initial expense for developing MMIC technology runs in the tens of millions of dollars — expenses that include new equipment, new personnel, and GaAs materials processing.

The main push to develop MMIC technology is coming from the military, the largest HMIC market, to reduce its overall cost of applications requiring hybrids. Some companies, such as M/A-COM Inc. of Burlington, Mass., and Watkins-Johnson Co. of Palo Alto, Calif., are already developing the technology based on a combination of military and corporate research funds.

Commercial markets for some companies will also be affected by MMIC technology. Analysts predict that the technology will be a large part of a new and potentially huge consumer communications market — direct broadcast satellite (DBS).

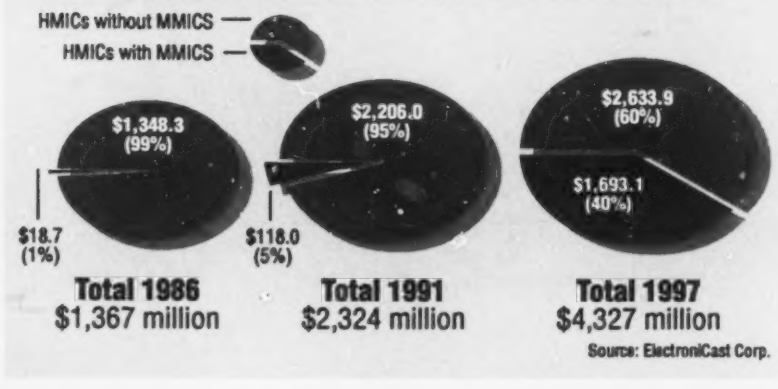
HMICs are typically thin-film circuits built on ceramic substrate. The primary use of HMICS has been for military applications, where the circuits are used in applications that require both resistance to extreme heat and small size — applications such as radar, missile guidance and communications systems.

Development of MMIC technology has everyone excited because a single MMIC chip could replace several of the components assembled on each circuit, while improving the performance of the circuit.

Jeff Montgomery, chairman of San Mateo, Calif., market research firm ElectroniCast, confirms that the shift toward employing MMIC chips is "the biggest single issue" in the HMIC market. He estimates that the use of MMICs in hybrid circuits will grow from 1% in 1986 to 5% in 1991, and up to 40% in 1997. This translates into a MMIC market that will increase from $18.7 million in 1986 to an estimated $1.7 billion by 1997.

Microwave IC market

MMIC penetration of North American hybrid MICs market ($ millions)



Source: ElectroniCast Corp.

Rosy markets

ElectroniCast's rosy market figures are based on the expected emergence of GaAs-based chips and their parallel to the emergence of silicon chips. In the case of silicon chips, once manufacturers figured out how to mass produce the silicon material cheaply, both the chips and the printed circuits on which they were assembled became cheaper and more powerful. If history is any indication, a circuit employing gallium arsenide chips could start a similar revolution in hybrid circuit manufacturing.

Robert Hamilton, product manager for MMICs at Varian Associates Inc., in Palo Alto, says, "In the long run, there will probably be some labor saving involved," although not in the short term. He estimates that the Solid State Operations California division of Varian, which is responsible for MMIC development, has $15 million invested in MMIC research to date.

Hamilton notes that many of the same manufacturing techniques HMIC manufacturers now use to create circuits can also be used to create a hybrid MMIC circuit. But he adds that to make hybrid MMICs cost effective, the MMIC chips "certainly have to be lower in price."

Mark Rosenzweig, group vice president of the Components Group at Adams-Russell Electronics Company Inc. in Waltham, Mass., focuses

on the future benefits of MMICs by saying, "If you can process everything in one shot, rather than assemble the different components, they're cheaper circuits." Fewer components, he adds, can also mean less time to test for each component's integrity.

Rosenzweig estimates that Adams-Russell uses MMIC chips in 5% of its military HMIC circuits and subsystems. He expects that figure to go as high as 25% in the next five years.

Some companies, such as California Amplifier Inc., buy the MMIC chips from other manufacturers, but assemble their own hybrid MMIC circuits. John Ramsey, regional sales manager for microwave products at California Amplifier, says, "We are already utilizing some MMIC technology." Ramsey thinks one of the company's bigger expenses will be in employing MMIC circuit and subsystem designers. He estimates that California Amplifier's use of MMICS will increase from 5% to 20% in the next five years.

MIMIC program

The Department of Defense is currently funding a seven-year research project concerning the manufacturing and use of microwave and millimeter wave monolithic integrated circuits, dubbed the "MIMIC" program.

Phase 0 of the MIMIC program, a one-year feasibility study, ended this past January. Phase I of the MIMIC program will run from 1988 through 1991, and contracts were awarded this past May to the prime contractors of Martin-Marietta Corp./ITT, $49.3 million; TRW Inc., $57.5 million; Raytheon Corp./Texas Instruments Inc., $68.6 million; and GM Hughes Electronics/General Electric Co., $50 million.

Phase I goals are to develop the technology to mass produce affordable MMIC chips that will be used in applications such as phased-array radar, electronic warfare, and smart munitions systems. James Fallon, vice president at M/A-COM, a subcontractor of MMIC chips to the Hughes/GE team, says that "MMICs are the fundamental base" for new military systems such as phased-array radar, which will be used in military planes and could also be used in radar for commercial planes.

More so than new systems, on which the military is cutting back, Fallon and other military contractors belive that MMIC technology will be big in the retrofit market, upgrading existing equipment such as F-14s and F-16s.

Thomas K. Wilson, manager of component marketing at Watkins-Johnson, says that "a major part of this program is to identify applications — for the MMIC to be effective, it has to be mass produced." He adds that the shift to MMIC technology "is a major step, but it is a slow evolution." (Watkins-Johnson is a subcontractor to the Martin-Marietta/ITT team.)

The main push to develop MMIC technology is coming from the military

While only a few companies have been selected for the military's MIMIC project, experts agree that nearly every HMIC manufacturer will benefit from the results of the project.

But other HMIC vendors are keeping an eye on commercial applications of MMIC — like DBS, a medium that will allow consumers to receive direct broadcasts from satellites.

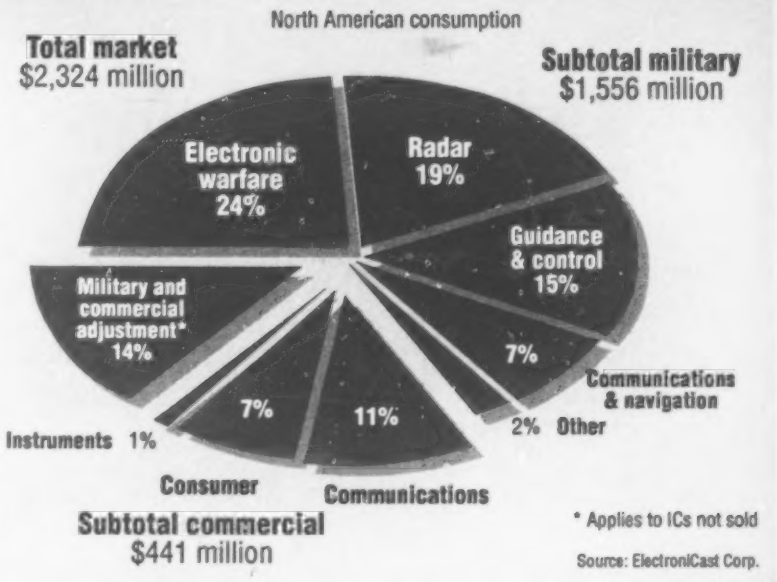
"DBS will be big," says William Strauss, president of Tempe, Ariz., market research firm Forward Concepts. He estimates that by 1991 or so, DBS applications will become more common.

DBS is being considered as an alternative to commercial and cable television. Consumers would need a receiver that was powerful enough to decode the satellite broadcasts and that would cost the consumer about as much as a fancy television.

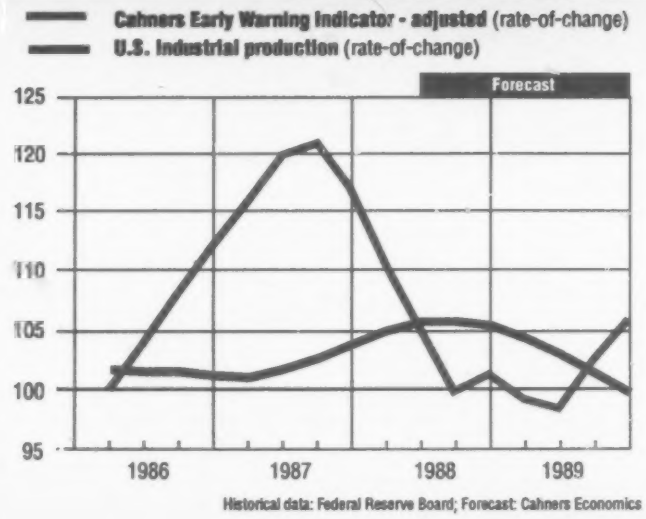
There are some problems, however. To pay for the service, says Strauss, the broadcast signals would most likely be scrambled the way that cable signals are scrambled. Then too, the receivers — mini-satellite dishes — would be expensive to produce initially, so there would have to be a large market.

Some North American companies that were gearing up for the DBS market in the mid 1980s were disappointed when the market was grounded by Federal Communications Commission regulations and by the difficulty of launching any satellites in the wake of the space shuttle disaster. During this time, however, foreign firms like The Plessey Company Plc and N.V. Philips GL took the lead in DBS and still hold it. Some American companies have sold, or are planning to sell, their satellite divisions. For example, M/A-COM sold off its $220 million Cable/Home Telecommunications subsidiary just two years ago, choosing instead to concentrate on the military market. □

Hybrid microwave IC applications — 1991

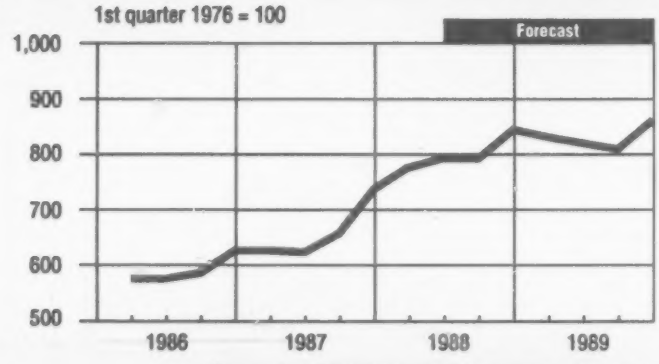


U.S. economic indicators



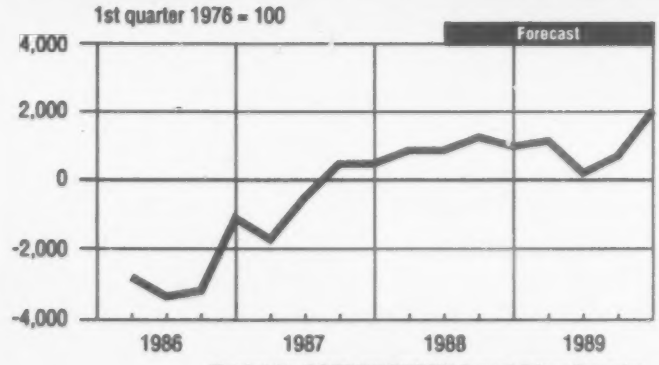
Historical data: Federal Reserve Board; Forecast: Cahners Economics

Automatic test equipment — Revenue index



Historical data: ELECTRONIC BUSINESS; Forecast: Cahners Economics

Automatic test equipment — Profits index



Historical data: ELECTRONIC BUSINESS; Forecast: Cahners Economics

U.S. production growth to remain steady until 1989

The indicator peaked in the third quarter of 1987 and is heading for a low point in the second quarter of 1989. But the downturn will be mild and short-lived, according the CEWI readings. The growth expected in U.S. industrial production has been revised downward slightly for 1988 by Cahners Economics. So, instead of slowly accelerating growth this year, industrial output will hover around the 5.1% to 5.9% range all year, before heading down in 1989. The reason for the revision? Inventories of imported goods are high. This could result in greater import price competition and U.S. manufacturers could feel the heat. Still, export growth and renewed business investment will steer U.S. industry to steady growth gains this year, albeit somewhat lower than Cahners' predictions several months ago.

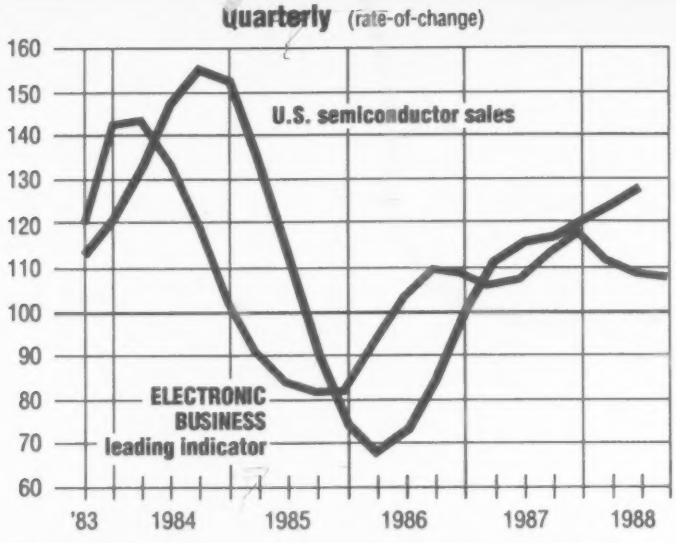
More information can be obtained from Elizabeth Baatz, economist, Cahners Economics Department, 275 Washington St., Newton, Mass. 02158.

ATE revenue and profits continue to improve

Manufacturers of automatic test equipment continue to see sales climb. In the second quarter of 1988, ATE worldwide sales rose almost 21% to $537 million, up from $526 million in the first quarter. Sales showed an even stronger 27% gain over the year-ago quarter's $423 million. The demand from computer and semiconductor manufacturers for automatic test equipment is expected to continue strengthening through the rest of this year. For the year, worldwide sales are expected to rise a sharp 21%, followed by a mild 3.6% increase in 1989.

ATE manufacturers returned to profitability in the second half of 1987 and are expected to remain so through 1989. During the second quarter, profits were down slightly from the prior quarter, but well above the losses of a year ago. Over the next three quarters, profits are expected to show healthy increases with a slowdown forecast in mid-1989.

ELECTRONIC BUSINESS leading indicator



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton, Mass., 02158, or call (617) 558-4368

The ELECTRONIC BUSINESS leading indicator held steady in June at 108.4, not far off from the 108.3 revised May value. Still, the extremely slow downward path of the indicator is expected to continue through part of next year. The indicator predicts a mild slowdown, but no crash for the electronics industry in 1989.

Source: Cahners Economics

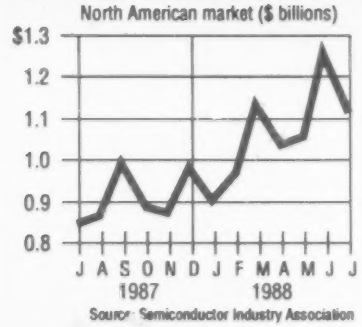
Electronics industry indicators this month

	Latest month	Previous month	Year ago	1987 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, June)	108.	108.5	108.2	111.8
U.S. semiconductor bookings ($ millions, 3-month average, July)	$1,260	$1,269	$985	$951
Weekly hours of semiconductor production workers (monthly average, June)	40.1	40.2	40.9	40.6
Electronic components leadtime index (1977 = 100, August)	117.9	123.2	120.3	100.7
S&P's semiconductor stock price index (1970 =10, monthly average, July)	61.1	64.6	68.9	65.5
Change in electronic components inventories ($ millions, SA, June)	+$101	-$2	+$885	+$47
Contract and orders for plant and equipment ($ billions, SA, June)	$39.3	$36.0	$35.9	$34.5

SA = seasonally adjusted, all other data is not seasonally adjusted

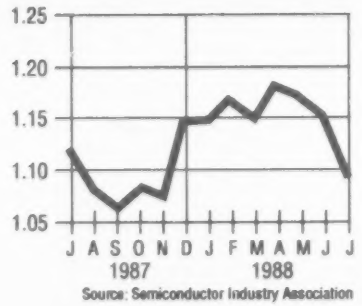
Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *ELECTRONICS PURCHASING* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

Semiconductor sales



Source: Semiconductor Industry Association

Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Source: U.S. Commerce Department